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CONTENTS

ARTICLES PAGE

Aerosol Spray Units for Control of Biting Insects.....C. S. Wilson 51
Observations on Mosquito and Malaria Control in the Caribbean Area. Part IV—Puerto Rico. H. H. Stage and H. O. Pratt 54
Mosquitoes Collected in the Vicinity of Hamilton, Ontario During the Summer of 1948. W. W. Judd 57
New Mosquito Distribution Records for Texas.....Myrtle E. Rueger and Stennette Druce 60
Notes on Mosquitoes in North America: I — New Distribution Records for Eastern United States During 1946 and 1947.....Stanley J. Carpenter 64
Results of the Pennsylvania Mosquito Survey for 1948.....S. W. Frost 65
An Annotated List of the Mosquitoes of New York. R. C. Barnes, H. L. Fellton and C. A. Wilson 69
New Distribution Records for the Mosquitoes of New England. H. L. Fellton, R. C. Barnes and C. A. Wilson 84

IN MEMORIAM 92

NEWS AND NOTES 95

EDITORIAL 98

ASSOCIATION NEWS 99

REVIEWS AND ABSTRACTS

A Malaria Survey of Liberia. By Martin D. Young and Thos. H. Johnson.....R. L. Armstrong 102
Twenty-Second Annual Report (1949) of the Desplaines Valley Mosquito Abatement District. F. C. Bishopp 102
Effects of DDT Mosquito Larviciding on Wildlife v. Effect on Fishes of the Routine Manual and Airplane Application of DDT and other Mosquito Larvicides. By C. M. Tarzwell. J. W. H. Rehn 102
The Effect of Various Insecticidal Combinations in Incense Coils on *Culex fatigans*. By H. T. Chang .....R. H. Nelson 103
Can Malaria be Controlled in the Philippines by DDT Residual Spraying of Houses? By H. F. Smith and F. J. Dy. ..... Authors' Summary 103
An Outbreak of Sylvan Yellow Fever in Uganda with *Aedes (Stegomyia) africanus* Theobald as Principal Vector and Insect Host of the Virus. By K. C. Smithburn, A. J. Haddow and W. H. R. Lumsden ..... Authors' Summary 104
Proceedings and Papers of the Seventeenth Annual Conference of the California Mosquito Control Association Held Jointly with the Annual Conference of the American Mosquito Control Association. ..... John D. DeCoursey 104
Handbook for Mosquito Researchers: Studies of Japanese Mosquitoes, 1948. .... D. J. Pletsch 105
Commentary on a Malaria Survey of Machakos District by J. C. J. Callanan. By D. Bagster Wilson. ..... Authors' Summary 105
Summary of the Annual Report of the Alameda County Mosquito Abatement District, Oakland, Calif. ..... J. S. Gibson 105
Effect on the Dark Rice Field Mosquito of Feeding on Cows Treated with DDT. By F. E. Whitehead. ..... John W. Scott 106
Mosquito Survey in Vermont, Report #2, 1949. By John W. Scott. ..... J.W.S. 106
Summary of the Annual Report of the Salt Lake City Mosquito Abatement District for 1949. J.W.S. 106
Annual Report Union County Mosquito Extermination Commission 1949. ..... J.W.S. 106

GENERAL BIBLIOGRAPHY 108

LIST OF ADVERTISERS 114

ADVERTISING RATES 107

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ARTICLES

AEROSOL SPRAY UNITS FOR CONTROL OF BITING INSECTS

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Roadhouses, camps, private homes and other small installations may be protected from the attacks of mosquitoes and other biting insects by use of aerosol spray units developed in Alaska in the season of 1949 (Figure 1). The design of these units jar reservoirs and are of the simple "flit-gun" type (Figure 3). They contain certain features that cause them to break the spray solution into very small droplets. This is essential if the spray is to remain air-borne long enough to be effective. The

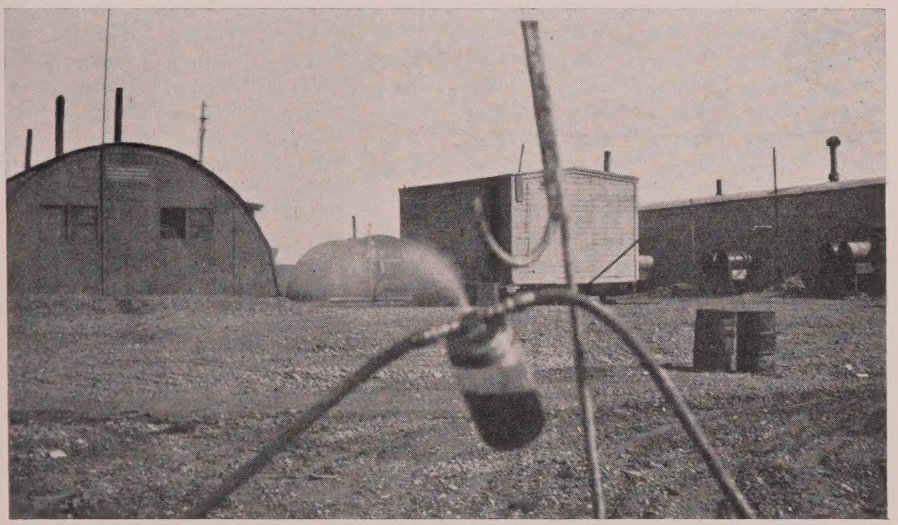

FIG. 1. Aerosol Spray Unit in Use at Umiat, Alaska — July 1949.

may be varied to suit individual problems, but all utilize special air operated nozzles to drift a mist of very small droplets of insecticide over the area to be protected. A single nozzle, operated by a very small diaphragm-type compressor, will usually take care of an area such as the front yard of an ordinary home. Larger areas require the use of a compressor of greater capacity and a series of nozzles spaced 50 to 100 feet apart along the windward side (Figure 2).

The nozzles are usually attached to fruit design of the nozzle also insures efficient use of material.

During periods of light and variable air movement, when the insects are most troublesome, the insecticidal mist fans out from each nozzle in a wide V. The length of this V depends on the size of the droplets and on the velocity of the air. Theoretical considerations and the experience of last year indicate that air carriage for 300 feet may usually be expected. Turbulence of the air is frequently advantageous in that it spreads the spray around.

A Typical Installation

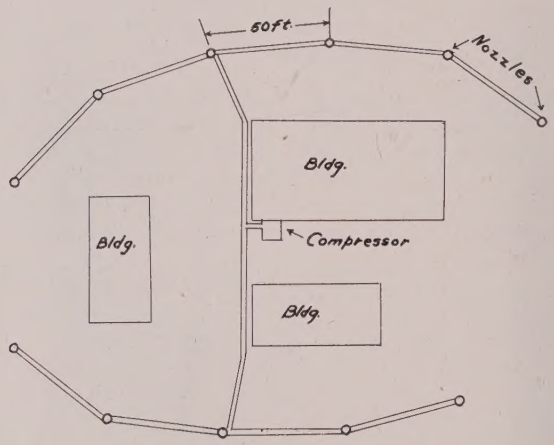

FIG. 2. Arrangement of nozzle units in relation to buildings.

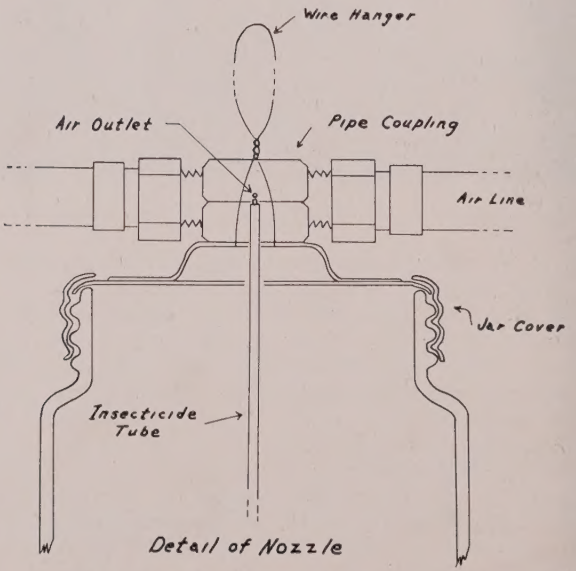

FIG. 3. Details of construction of nozzle unit.

It was found at one camp on the Arctic slope that mosquitoes were moving and biting in steady winds of 10 miles per hour. In this case, the mist from each nozzle was carried in long straight streams permitting the mosquitoes to come in between the streams and bite before being affected by the insecticide.

Although a single nozzle may be enough to protect an ordinary home, it is some trouble to move it with each change of the wind. It is sometimes preferable to set two or three nozzles at favorable locations and move the compressor to them. This works very well if a small electrically driven compressor is used and power lines are brought to each nozzle location. Another method is to leave the compressor in one location and run an air line to each nozzle so that any one nozzle can be put in operation by turning a valve.

The same considerations apply to the construction of the larger units that operate a series of nozzles. The whole outfit may remain in place, the nozzle lines may be made stationary and only the compressor moved, or the whole outfit may be moveable. In most cases it is best to start with a portable unit and add alternate nozzle lines as need for them is demonstrated and as their proper location is determined. After a few months' operation it is often found that the light air movements prevailing at the times of insect attacks come from only one or two directions so that the installation need not be as elaborate as originally expected.

There are a number of light-weight diaphragm-type compressors now on the market that are surprisingly cheap and efficient at the low pressures required for this work. Gasoline driven compressors are, of course, heavier but necessary where electric power is not available. The piston type compressors commonly used in garages are heavier and more expensive than is necessary for this type of spraying. They may be preferred however, where they are also needed for tire inflation or other purposes requiring high working pressures. The compressor capacity required for a job can be estimated as slightly less than one cubic foot per minute of free air for each nozzle. A diaphragm compressor rated at 4.7 cubic feet per minute operates five to six nozzles satisfactorily.

Ordinary air hose of ¼ inch, inside diameter, is usually used for the air lines although copper tubing or iron pipe may be used in permanent installations. Fittings of the "quick connecting" type greatly facilitate the setting up and dismantling of units that are frequently moved. Ordinary fittings, however, are much cheaper and are quite satisfactory for most installations.

The nozzles are attached to the tops of the reservoirs and are designed so that all of those on a single air line are put in operation by simply turning on the compressed air. Brass pipe couplings with holes bored in their sides with a No. 58 wire gauge drill (.048 inch, diameter) serve as air jets. The air line is connected to each end of the coupling so that the compressed air may pass through it and on to the next nozzle.

The insecticide solution is brought to the nozzle by suction through a tube soldered to the bottom of the coupling and extending into the reservoir. The top of this tube is centered in the air jet by bending. The insecticide tube and its relation to the air jet is the critical part of the nozzle. It is essential that the end of the tube be thin-walled, smooth and sharp-edged, and that it stand at exactly right angles to the air jet.* If the top of the tube is uneven, thick walled, or bent in the direction of the air stream, the spray droplets will be too large. If the top of the tube is bent toward the jet, air will be driven into the reservoir and the nozzle will not function. Air is wasted if the top of the tube is too far from the opening of the air jet or is not exactly centered in the stream.

The tip of the insecticide tube is made

* These features were suggested by Mr. C. N. Husman, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture.

of seamless steel or brass tubing, preferably of 20 gauge hypodermic needle tubing, .025 inch, inside diameter. The end is squared and carefully sharpened. About a quarter of an inch of this sharpened end is then cut off and soldered into the end of a piece of ¼ inch soft copper tubing long enough to reach the bottom of the reservoir.

The coupling that forms the air jet is fastened to the top of the reservoir by means of a piece of thin metal that is bent upward to allow space for tightening the fittings. A double wire loop around this part of the assembly helps hold the parts together while they are being soldered and furnishes a hanger for the nozzle during operation.

Properly constructed nozzles deliver about one quart of insecticide per hour, therefore Mason fruit jars of one or two quart capacity serve well as reservoirs. The nozzle assembly is attached to the jar lid so that the jar can be removed for filling by unscrewing the ring. Metal cans of larger capacity may be used but lack transparency so that the need of refilling cannot be seen from a distance.

The only insecticide that has been used in the unit thus far is a 20 per cent solution of DDT in Velsicol NR-70. This has been satisfactory under ordinary conditions but acts somewhat slowly. In cases where mosquitoes are moving rapidly and in great numbers, as they do in the Arctic, it has been found that some may come in and bite before being knocked down. Studies to develop improved insecticide formulas are planned for next season.

OBSERVATIONS ON MOSQUITO AND MALARIA CONTROL IN THE CARIBBEAN AREA. PART IV — PUERTO RICO

BY

H. H. STAGE [1] AND H. O. PRATT [2]

En route from Trinidad to the States late in April 1946, the senior author stopped over for a few days in Puerto Rico. Here a bird's-eye picture of mosquito and malaria control was given him by the junior author.

Briefly, Puerto Rico presents an attractive combination of many desirable physical and climatic features, especially for the planter and for the tourist. The island is primarily agricultural, and much land is given to the raising of sugarcane, tobacco, coffee, citrus fruits, and pineapples. The geographical position of the island within the trade-wind belt, combined with its high elevation above sea level, makes it one of the most favorable regions within the tropics. The name "Riviera of the Caribbean," often applied to the island of Trinidad, is equally appropriate for lovely Puerto Rico.

While flying over the island, one sees only a confused mass of small mountains. They really are part of a well-defined ridge, the Cordilleras, which extends the full length of the 150-mile-long island. The highest peaks range from 2,000 to almost 4,400 feet. The lowlands are found only along the coast in a narrow belt not more than 5 miles in width.

The annual mean temperature for the island is about 73 degrees Fahrenheit during the coolest month (January) and about 79 degrees during the warmest month (August). The differences in

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temperature between shade and sunshine are much greater than as we know them in the States. Also the difference between day and night temperatures is considerably greater than the difference between the average summer and average winter temperature. The nights are comfortably cool, and the day's heat is tempered by the refreshing and persistent trade winds blowing from the eastern sea and by the decreasing relative humidity.

The average annual rainfall is close to 80 inches. In the mountainous sections it may exceed 135 inches, whereas along certain portions of the south coast it is less than 40 inches.

It is unfortunate that Puerto Rico with such an agreeable climate should have been inflicted with malaria. This disease has long constituted a serious health problem on the island, and although it is most severe along the coast no part of the island is entirely free from the ravages of the disease. As many as 1,000 or even 2,000 deaths annually have been caused by malaria alone. During World War II, over a million dollars was spent in 1942 and 1943 by various insular and federal government agencies in efforts to curb it.

MOSQUITOES OF PUERTO RICO

In 1937 Tulloch(1) reported 27 species of mosquitoes in Puerto Rico, but subsequent collecting and study have given us 29 species which appear authentic. The most important species may be grouped as follows according to their breeding places:

Stagnant water: *Culex quinquefasciatus* Say, *C. nigripalpus* Theo., *Aedes aegypti* (L.), and *Anopheles albimanus* Wied.

Field water: *Culex pilosus* (D. and K.), *Aedes taeniorhynchus* (Wied.), *A. tortilis* (Theo.), *A. grabhamii* Theo., *Psorophora pygmaea* (Theo.), and *P. confinnis* (L.A.).

Crab holes: *Deinocerites cancer* Theo.

Tree holes: *Aedes mediovittatus* (Coq.) and *Megarhinus portoricensis* von Roeder.

Axils of air plants: *Culex americanus* Neveu-Lemaire, *Megarhinus portoricensis,* and *Wyeomyia* sp.

Of the three species of *Anopheles* found in Puerto Rico—*A. albimanus, A. grabhamii,* and *A. vestitipennis* D. and K.—*albimanus* is by far the most abundant in larval, animal-bait-trap, and light-trap collections. It is the most abundant species on the coastal plains of Puerto Rico, that portion of the island in which the highest malaria rates occur. Ever since the pioneer work of Dr. Walter C. Earle and the Rockefeller Foundation from 1920 to 1924, *albimanus* has been considered the most important species on this island with regard to malaria transmission. During World War II malaria control activities of the United States Public Health Service, Army, Navy, and the Puerto Rico Department of Public Health were directed toward control of this species. "Species sanitation" in Puerto Rico was directed toward control of *A. albimanus* in the same way that control programs in the United States were directed against *A. quadrimaculatus* Say.

Anopheles albimanus larvae breed in various aquatic situations (Meyer 2). They prefer clean water with some algal growths or nonvital flotage, such as sugarcane trash, fully exposed to the sunlight. They do occur, however, in densely shaded situations, such as crab holes and mangrove swamps, during the dry seasons. They may occur in rather large bodies of water, such as irrigation reservoirs, or in very small ones, such as cattle hoofprints filled with water, especially during the rainy season. In Puerto Rico this species can breed in brackish water containing as much as 50 percent of sea water. Breeding of *albimanus* decreases markedly in water containing more than 50 percent of sea water, and Hurlbut(3) has shown that the Puerto Rican strain of this species cannot reproduce in water containing more than 75 percent of sea water. As a result of his work *albimanus* breeding has been eliminated in some brackish-water mangrove swamps on Vieques Island and in parts of Puerto Rico by ditching to bring sea water into such areas. Here is a good example of mosquito control by ecological means.

Collections of *Anopheles albimanus* are made in routine manner using the Caribbean-type animal bait trap or the New Jersey-type light trap. There are usually two peaks in *albimanus* populations, one at the beginning of the rainy season, in April, and another toward the end of the rainy season, in October.

Since 1930 maximum bait-trap collections from individual traps for a single night range from 3,000 to 5,500 whereas the maximum light-trap collection from 1942 to date is 1,350. Studies by the Department of Public Health and other control agencies in Puerto Rico have indicated that the light trap may collect more specimens of *albimanus* than an animal-bait trap nearby, but there is a cyclical fluctuation in numbers of specimens caught in light traps as the moon waxes and wanes, making it difficult to interpret light-trap data.

Anopheles grabhamii is the second most abundant species of malaria mosquito in Puerto Rico. It breeds by preference in shady situations, particularly in irrigation or drainage ditches in sugarcane fields, in mangrove swamps, or in damp meadows with tall grass or sedges. It is most abundant during the fall and winter months, and some animal-bait traps have contained as many as 1,340 specimens of this species in a single night. It is found more frequently in daytime resting places, such as in barns or under houses, than is *A. albimanus,* but its importance in malaria control in Puerto Rico has not been demonstrated at the present time.

Anopheles vestitipennis is the rarest of the three malaria mosquitoes in Puerto Rico. The larvae breed in densely shaded water areas and, so far as is known, only in fresh water. It is a rare and locally distributed species. The largest collection that has been made in a bait trap contained 263 specimens.

MALARIA CONTROL

Until 1944 malaria-control operations in Puerto Rico consisted chiefly of drainage, frequently with a pumping station at the outlet portion of the drainage system, and larviciding with paris green or diesel oil. Neither of these methods was entirely satisfactory in preventing seasonal rises in *Anopheles albimanus* during the rainy season, although control operations did shorten the period when collections were high. In 1944 the United States Army introduced airplane dispersal of DDT (5- to 10-percent solution of diesel oil), which was markedly successful in reducing counts of this species in a few weeks. In 1945 the Navy began similar control operations with airplanes. In 1946 both the Army and the Navy were using airplanes equipped with thermal aerosol apparatus with marked success. In 1945 the Public Health Service (Neill 4) began larviciding with a 0.5-percent emulsion of DDT in diesel oil with Triton B-1956 (a phthalic glyceryl alkyd resin) as emulsifier. This larvicide gave much better control, especially during the rainy season, than paris green or diesel oil had done during the years 1942 to 1945.

In 1944 the United States Public Health Service, the Puerto Rican Department of Public Health, and the School of Tropical Medicine began a residual DDT spray program in the village of Humacao Playa. A preliminary report on the results of this first year's work has already been published (Stephens and Pratt 5). Residual DDT spraying has given such promise of reducing the malaria rate in rural areas where malaria control by drainage or larviciding is not economically feasible, that the Puerto Rican Department of Public Health has begun an extensive program covering much of the coastal area of the island. Preliminary surveys in several of the sprayed villages indicate a significant reduction in malaria.

DDT has shown itself to be such an excellent insecticide against *Anopheles albimanus* that the Puerto Rican Department of Public Health is considering a campaign to eradicate this species from the island (Stage 6). Henderson(7) has discussed such a program in detail and a practical

test may be initiated on Vieques Island (an island 20 miles long by 3 miles wide), some 6 miles east of Puerto Rico in the near future.

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MOSQUITOES COLLECTED IN THE VICINITY OF HAMILTON, ONTARIO DURING THE SUMMER OF 1948

W. W. JUDD [1]

INTRODUCTION

During June, July and August of 1948 a collection of mosquitoes was made in the vicinity of Hamilton, Ontario. The work was sponsored by the Research Council of Ontario and the Board of Health of the City of Hamilton in connection with a survey of the wildlife of Wentworth County, Ontario conducted by the Department of Zoology of McMaster University under the direction of Professor A. E. Warren. Mr. A. Rayner, Research Assistant, made collections of larvae and pupae, reared adults from cultures of the young stages and prepared adults for identification. In a previous survey in 1944 (Twinn, 1944a,b) the mosquito population had been investigated at Ancaster, Ontario (see map, fig. 1) and the following species had been collected: *Anopheles punctipennis* Say, *A. quadrimaculatus* Say, *Culex pipiens* L., *Aedes vexans* Meigen and *Uranotaenia sapphirina* (Osten Sacken).

[1] Assistant Professor of Zoology, McMaster University.

METHODS

During the summer of 1948 collections of larvae and pupae were made from streams, ponds and temporary pools and from water in rain barrels, pails, etc., in the vicinity of the west end of Hamilton and nearby villages (fig. 1). The insects were scooped from the water with glass jars or with a small net of fine mesh. The larvae and pupae were reared in lots of five to ten in glass jars covered with mosquito netting. Each jar contained water and sediment from the body of water or container from which the larvae and pupae had been taken. When adults emerged from the water they were left for a few hours in the jar in order to allow the integument to harden and were then removed from the jar, killed with cyanide and pinned. In all, ten cultures of larvae and pupae were collected and adults were reared from them. The sources of the cultures were distributed as follows and are numbered to correspond with numbered localities on the map (fig. 1):

1. Shallow pond, in meadow surrounded by willow trees, containing clear

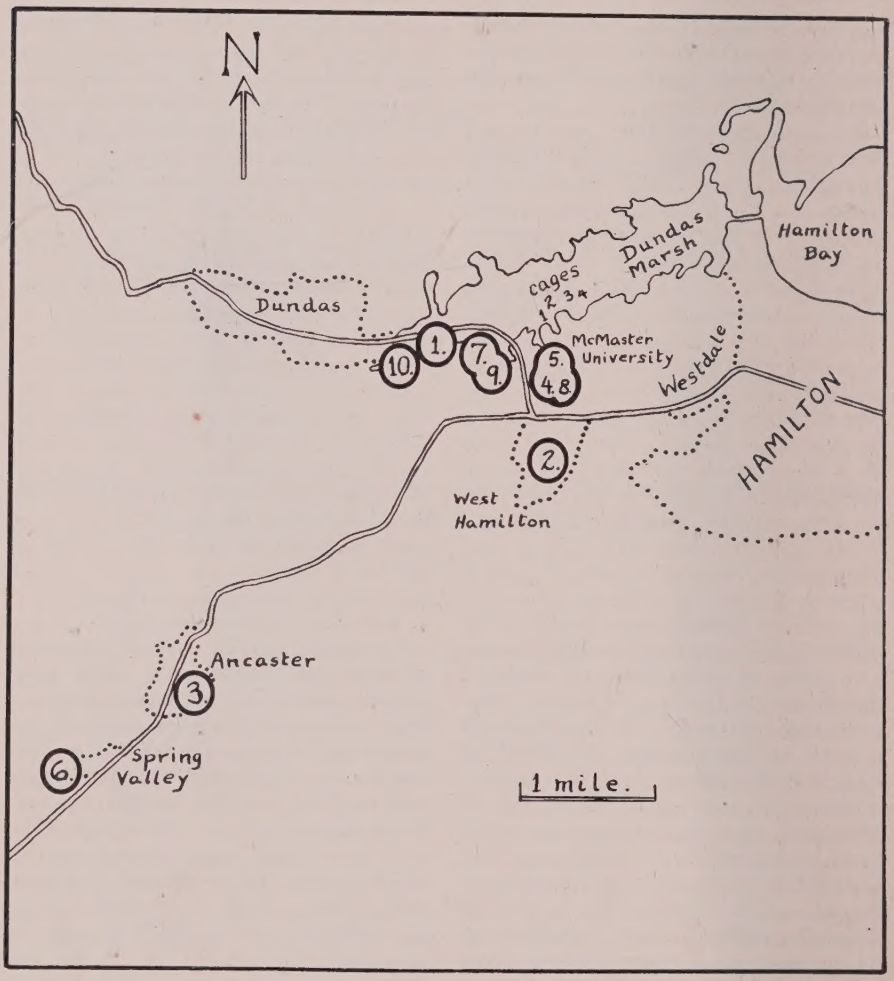

FIG. 1

water and decaying leaves, along highway between Hamilton and Dundas, June 1.

2. Rain barrel containing sediment of decaying leaves, West Hamilton, June 16.

3. Rain barrel, Ancaster, July 20.

4. Barrel, McMaster University campus, July 21.

5. Barrel, McMaster University campus, July 28.

6. Well, two feet deep, containing clear water and muddy sediment, Spring Valley, July 29.

7. Rain barrel, railway bridge between Hamilton and Dundas, Aug. 5.

8. Rain barrel, McMaster University campus, Aug. 10.

9. Rain barrel, railway bridge between Hamilton and Dundas, Aug. 13.

10. Pail of water near highway between Hamilton and Dundas, Sept. 1.

Adult mosquitoes were caught in flight as opportunity arose and were captured about windows and dwellings by the use of cyanide tubes. A few of these were taken in 1947. In addition, adults emerg-

ing from the waters of the Dundas Marsh were caught in cages (1,2,3,4) (fig. 1) on the marsh. These cages were set out over growths of aquatic and submerged vegetation in water of various depths, at points where they had been set out previously, in 1947, (Judd, 1949) to capture emerging insects. Each cage consisted of a wooden frame, covered with copper screening, 36 in. long, 32 in. wide and 36 in. tall, the bottom being open. Each cage was fixed firmly over four stakes, driven into the bottom of the marsh, so that the lower border was about 6 in. below the surface of the water. As insects emerged from the water they were trapped in the cage and were removed each day through a door along the side of the cage.

Pinned adults were identified by use of keys in Dyar (1921) and Matheson (1944). Representative specimens were sent to Professor R. H. Ozburn of the Ontario Agricultural College, Guelph and to Mr. G. E. Shewell of the Division of Entomology, Department of Agriculture, Ottawa, who kindly checked the identifications.

Mosquitoes Collected

Anopheles quadrimaculatus Say

One adult was captured in a window in Hamilton, Sept. 3, 1947 and one male and one female were trapped in cage 2 (water depth—23 in.) on the Dundas Marsh, Sept. 3, 1948.

Anopheles walkeri Theobald

One adult was captured from a window in Hamilton, June 12.

Anopheles occidentalis Dyar and Knab

One adult was captured in flight about the Dundas Marsh on March 21 and another was trapped in cage 3 (water depth —35 in.) on the Dundas Marsh, Aug. 14.

Aedes vexans Meigen

Three adults were captured in flight at Hamilton, May 26 and 16 were reared from culture 1 between June 2 and June 11.

Culex apicalis Adams

Two adults emerged from the Dundas Marsh, one in cage 4 (water depth—49 in.) on Aug. 3, the other in cage 1 (water depth—20 in.) on Aug. 10.

Culex restuans Theobald

This species occurred commonly in cultures, and the following series of adults were reared: 21 from culture 2 between June 16 and June 19; 5 from culture 3 on July 23; 9 from culture 4 between July 22 and July 26; 25 from culture 7 on July 9 and 10; 11 from culture 9 on Aug. 13; 1 from culture 10, Sept. 11.

Culex pipiens L.

Four adults were captured in flight in Hamilton on July 7 and one on Sept. 13. Three were trapped in cages on the Dundas Marsh, 2 in cage 3 (water depth—38 in.) on Aug. 3 and 1 in cage 1 (water depth—17 in.) on Aug. 14. The following series of adults were reared (in several cases in company with *C. restuans*) from cultures: 2 from culture 2 on June 18; 3 from culture 3 on July 23; 43 from culture 4 between July 22 and July 28; 16 from culture 5 on Aug. 5; 7 from culture 6 between July 29 and Aug. 5; 8 from culture 7 on Aug. 10; 5 from culture 8 on Aug. 12; 10 from culture 9 on Aug. 13.

Mansonia perturbans Walker

Several adults were captured in flight in Hamilton and Westdale between June 12 and July 19. Two adults emerged from the Dundas Marsh, one from cage 3 (water depth—38 in.) on Aug. 3 and one from cage 4 (water depth—46 in.) on Aug. 13.

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NEW MOSQUITO DISTRIBUTION RECORDS FOR TEXAS

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The extensive mosquito survey program carried on by army installations in the Eighth Service Command in 1944 and 1945 added considerable information to that already available on the distribution of Texas mosquito species. Distribution records of Texas mosquitoes have been recorded by McGregor and Eads (1943), O'Neill, *et al.* (1944) and the Texas State Health Department (1944). New mosquito records obtained as a result of the 1944 and 1945 army program are here presented. These records include three new state and 107 additional locality records and were obtained from 298,280 specific identifications of mosquitoes collected at thirty-two army installations in Texas during the two years.

Three species, *Aedes dupreei, Culex peccator* and *Deinocerites epitedeus,* are recorded from Texas for the first time. Of interest also are the numerous inland occurrences of salt water Aedes. Both *Aedes sollicitans* and *Aedes taeniorhynchus* were found as far inland as Sheppard Field (Wichita county). Another record worthy of special mention is that of the occurrence of *Anopheles albimanus* at Laredo, about 160 miles northwest of Brownsville. Eads (1946) reported this species from Corpus Christi.

The different types of collections are indicated as follows:

Biting or while resting on person collections..(B)
Larval collections .....(L)
Net collections .....(N)
Diurnal resting place collections.....(R)
Light trap collections (New Jersey type)....(T)

Arrangement of data: Species, county, station, year, type of collection, number of specimens collected, months.

Aedes alleni Turner: BROWN—Camp Bowie, 1945: (T) 1♂ May, 1♀ June. COLLIN—Ashburn General Hospital, 1944; (R) 1♀ June. PARKER—Camp Wolters, 1945: (R) 1♂ 1♀ April, 1♂ 1♀ May, 1♀ June, 1♂ July; (T) 3♂ 2♀ May, 3♂ June.

Aedes atropalpus (Coquillett): BROWN—Camp Bowie, 1945: (R) 1♂ April, 1♀ May, 2♀ July, 1♀ August, 1♀ September. CORYELL — Camp Hood, 1945: (L) 5 May. PARKER—Camp Wolters, 1945: (R) 2♀ April.

Aedes canadensis (Theobald): LAMAR—Camp Maxey, 1945: (B) 2♀ April; (L) 138 March, 58 April, 37 May, 11 June, 1 July; (R) 2♂ March, 29♂ 1♀ April, 1♀ May.

Aedes dorsalis (Meigen): WICHITA—Sheppard Field, 1945: (T) 1♂ 4♀ June.

Aedes dupreei (Coquillett): * BEXAR—Fort Sam Houston, 1945: (T) 1♂ April. LAMAR—Camp Maxey, 1945: (L) 2 May.

Aedes infirmatus Dyar and Knab: BEXAR—Camp Bullis, 1944: (L) 2 May. Fort Sam Houston, 1944: (T) 1♂ September.

Aedes mitchellae (Dyar): BEXAR—Fort Sam Houston: (L) 1 April 1944, 1 August 1944, 1 March 1945; (T) 1♂ June 1944. WEBB—Laredo Army Air Field, 1944: (L) 6 May, 25 November. WICHITA—Sheppard Field, 1945: (L) 1 July; (T) 1♂ April.

Aedes nigromaculis (Ludlow): BROWN—Camp Bowie, 1945: (L) 2 March, 36 April, 1 May; (T) 7♂ 7♀ March, 1♂ 2♀ April, 1♂ 2♀ May, 1♂ 8♀ June, 1♂ 21♀ July, 1♀ August. FREESTONE—Camp Mexia, 1945: (L) 1 March. GALVESTON—Ellington Field, 1945: (L) 1 April, 2 July; (R) 1♂ May, 2♀ June; (T) 1♀ September. LAMAR—Camp Maxey,

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1945: (L) 2 March, 13 April; (R) 1♂ June. TAYLOR—Camp Barkeley, 1945: (L) 2 March. TRAVIS—Bergstrom Field, 1945: (L) 49 April; (T) 6♀ June. WEBB—Laredo Army Air Field, 1945: (R) 17♀ January. WICHITA—Sheppard Field: (B, 1945) 10♀ March, 13♀ April, 1♀ July; (L, 1945) 3 April, 1 May, 3 July; (R, 1945) 2♀ March, 14♀ April, 2♀ May, 7♀ July; (T) 3♀ September 1944, 6♂ 16♀ October 1944, 3♂ 4♀ March 1945, 6♂ 9♀ April 1945, 1♂ 5♀ May 1945, 10♂ 8♀ June 1945, 2♂ 37♀ July 1945.

Aedes sollicitans (Walker): BEXAR—Fort Sam Houston: (L, 1944) 5 January, 2 June; (T) 1♀ July 1945. COOKE—Camp Howze, 1945: (R) 1♀ July. TRAVIS—Bergstrom Field, 1945: (T) 3♀ June. WEBB—Laredo Army Air Field: (B, 1945) 7♀ March, 22♀ April, 9♀ May, 3♀ June, 1♀ July; (L, 1945) 2 February, 72 April; (R) 4♀ October 1944, 27♀ March 1945. WICHITA—Sheppard Field, 1945: (B) 3♀ July; (L) 5 July, 1 August; (R) 1♀ April, 29♀ July, 2♀ August; (T) 2♂ April, 12♂ 10♀ June, 6♀ July.

Aedes taeniorhynchus (Wiedemann): BEXAR—Fort Sam Houston: (T) 2♂ September 1944, 9♂ 4♀ October 1944, 1♂ November 1944, 5♂ September 1945, 3♀ October 1945. WEBB—Laredo Army Air Field: (L) 8 April 1945; (R) 2♀ October 1944. WICHITA — Sheppard Field, 1945: (R) 5♂ 1♀ June, 2♂ 1♀ July; (T) 11♂ 2♀ June, 1♂ 1♀ July.

Aedes thelcter Dyar: WEBB—Laredo Army Air Field, 1945: (L) 4 April.

Aedes tormentor Dyar and Knab: LAMAR—Camp Maxey, 1945: (L) 1 July.

Aedes triseriatus (Say): LAMAR—Camp Maxey, 1945: (B) 1♀ May; (L) 22 March, 174 April, 403 May, 203 June, 110 July, 96 August; (N) 7♂ 1♀ May; (R) 2♂ April, 1♀ May, 1♀ July. WICHITA—Sheppard Field, 1945: (R) 1♀ July.

Aedes trivittatus (Coquillett): LAMAR—Camp Maxey, 1945: (B) 1♀ May. WICHITA—Sheppard Field, 1945: (B) 1♀ June; (R) 2♀ July; (T) 1♂ April.

Aedes vexans (Meigen): COOKE—Camp Howze: (L) 6 May 1944; (R) 2♀ July 1945. PARKER—Camp Wolters, 1945: (L) 3 May; (R) 1♀ April; (T) 1♂ May. WALKER—Huntsville, 1944: (L) 4 May. WEBB—Laredo Army Air Field, 1944: (L) 1 May. WICHITA—Sheppard Field, 1945: (B) 1♀ April, 1♀ August; (L) 3 April, 440 May, 13 July, 1 August; (R) 1♂ 2♀ April, 6♀ June, 8♀ July; (T) 1♀ March, 3♂ 7♀ April, 3♂ 11♀ May, 43♂ 13♀ June, 8♂ 35♀ July.

Anopheles albimanus Wiedemann: WEBB—Laredo Army Air Field, 1944: (R) 1♀ October.

Anopheles barberi Coquillett: LAMAR—Camp Maxey, 1945: (L) 6 August; (R) 1♀ April. PARKER—Camp Wolters, 1945: (R) 5♂ April, 1♂ May, 1♂ June.

Anopheles crucians Wiedemann: WICHITA—Sheppard Field, 1945: (L) 3 July; (R) 1♀ July, 1♂ August.

Anopheles pseudopunctipennis Theobald: WICHITA—Sheppard Field, 1945: (R) 1♀ September; (T) 1♀ May.

Anopheles punctipennis (Say): WICHITA—Sheppard Field: (B) 1♂ August 1945; (L) 6 September 1944, 27 May 1945, 42 July 1945; (R, 1945) 3♀ April, 2♀ May, 53♂ 44♀ July, 11♂ 12♀ August, 10♂ 9♀ September; (T, 1945) 3♂ 1♀ July.

Anopheles quadrimaculatus Say: WICHITA—Sheppard Field: (B, 1945) 1♂ 1♀ August; (L, 1945) 2 May, 1 July; (R) 1♀ October 1944, 1♀ June 1945, 1♂ 6♀ July 1945, 17♂ 29♀ August 1945, 8♂ 37♀ September 1945.

Culex abominator Dyar and Knab: BROWN—Camp Bowie, 1945: (L) 1 August. LAMAR—Camp Maxey, 1945: (L) 2 May.

Culex apicalis Adams: BOWIE—Red River Ordnance, 1945: (L) 2 April, 15 May. COLLIN—Ashburn General Hospital, 1944: (L) 2 May. COOKE—Camp Howze, 1944: (L) 1 April. LAMAR—Camp Maxey, 1945: (B) 1♂ May; (L) 41 March, 242 April, 172 May, 59 June,

22 July, 20 August, 2 September; (N) 1♂ May; (R) 2♀ April, 5♂ May, 1♀ August. PARKER—Camp Wolters, 1945: (R) 1♂ June, 1♂ July, 3♂ August.

Culex coronator Dyar and Knab: WEBB—Laredo Army Air Field, 1944: (L) 1 October.

Culex declarator Dyar and Knab: BEXAR—Fort Sam Houston: (T) 1♂ October 1944, 3♂ 1♀ November 1945, 1♂ 1♀ December 1945. CAMERON—Harlingen Army Air Field, 1945: (T) 1♂ August.

Culex interrogator Dyar and Knab: BEXAR—Fort Sam Houston, 1944: (L) 73 September.

Culex nigripalpus Theobald: CORYELL—South Camp Hood, 1944: (L) 1 June. WEBB—Laredo Army Air Field, 1944: (L) 2 December.

Culex peccator Dyar and Knab: * BEXAR—Fort Sam Houston: (T) 2♂ July 1944, 1♂ September 1944, 2♂ October 1944, 2♂ November 1944, 1♂ June 1945, 4♂ August 1945, 4♂ September 1945, 2♂ October 1945, 1♂ November 1945. BOWIE—Red River Ordnance, 1945: (T) 1♂ September. WICHITA—Sheppard Field, 1945: (R) 1♂ August.

Culex restuans Theobald: BOWIE—Red River Ordnance, 1945: (L) 6 March, 138 April, 48 May; (T) 1♀ April, 1♂ 1♀ May, 6♀ September, 14♀ October. BROWN—Camp Bowie, 1945: (L) 7 April; (R) 1♂ 1♀ April, 1♂ 2♀ May, 2♂ 2♀ June, 1♂ July. LAMAR—Camp Maxey, 1945: (B) 1♂ May, 3♂ June; (L) 117 March, 1208 April, 340 May, 176 June, 70 July, 93 August, 18 September; (R) 4♀ March, 18♂ 17♀ April, 23♂ 1♀ May, 2♂ 1♀ June; (T) 1♂ July, 1♂ August. WICHITA—Sheppard Field, 1945: (L) 13 May, 71 July, 3 August; (R) 1♀ April, 2♂ 4♀ May; (T) 1♀ April, 3♀ May, 1♀ June, 1♂ 1♀ July.

Culex salinarius Coquillett: BOWIE—Red River Ordnance, 1945: (L) 5 May; (T) 8♀ April, 9♂ 81♀ 1? May, 1♂ 8♀ June, 28♀ July, 10♀ August, 2♂ 25♀ September, 13♀ October. BROWN—Camp Bowie, 1945: (L) 5 May; (R) 1♀ May; (T) 1♀ March, 1♀ April, 3♂ 2♀ May. COLLIN—Ashburn General Hospital, 1944: (R) 3♀ June. COOKE—Camp Howze, 1944: (L) 1 April. CORYELL—Camp Hood, 1945: (L) 1 May, 2 July. South Camp Hood, 1944: (L) 2 April, 1 June. LAMAR—Camp Maxey, 1945: (B) 3♀ June; (L) 35 April, 72 May, 119 June, 19 July, 47 August, 16 September; (N) 5♀ May; (R) 1♂ 1♀ March, 3♂ 5♀ April, 2♂ May, 1♀ June, 1♂ August, 4♂ 6♀ September; (T) 1♀ July, 5♂ 6♀ August. PARKER—Camp Wolters, 1945: (L) 1 April, 6 May; (R) 5♂ 6♀ April, 5♀ May, 4♂ 4♀ June, 1♂ 1♀ July, 1♂ 2♀ August; (T) 10♂ 3♀ May, 5♂ 10♀ June. WEBB—Laredo Army Air Field: (L) 1 May 1944, 2 March 1945, 1 May 1945. WICHITA—Sheppard Field, 1945: (L) 36 May, 3 June, 5 July; (R) 2♀ April, 1♂ 2♀ May, 1♀ June, 6♂ 1♀ July, 1♂ August, 5♂ 1♀ September; (T) 3♂ 55♀ April, 9♂ 28♀ May, 12♂ 9♀ June, 24♂ 21♀ July.

Culex thriambus Coquillett: BEXAR—Fort Sam Houston: (L) 9 April 1944, 14 June 1944, 46 July 1944, 6 October 1944, 227 November 1944, 1 January 1945, 37 February 1945, 53 March 1945, 117 April 1945, 264 May 1945, 110 June 1945, 86 September 1945, 8 November 1945, 10 December 1945; (T) 1♂ August 1944, 1♂ November 1944, 1♀ January 1945, 1♂ April 1945, 1♂ 1♀ May 1945, 1♀ July 1945, 1♂ August 1945, 1♂ November 1945. San Antonio, 1944: (L) 14 June. BROWN—Camp Bowie, 1945: (R) 1♂ May. PARKER—Camp Wolters, 1945: (R) 1♀ July. WEBB—Laredo Army Air Field: (L) 2 May 1945; (R) 1♀ October 1944.

Deinocerites epitedeus (Knab): * CAMERON—Harlingen Army Air Field, 1945: (T) 1♂ March.

Mansonia perturbans (Walker): GALVESTON—Ellington Field, 1945: (R) 1♀ April, 2♀ August; (T) 2♀ September. PARKER—Camp Wolters, 1945: (T) 1♀ May.

* Previously unrecorded from Texas.

Megarhinus septentrionalis Dyar and Knab: BEXAR—Fort Sam Houston, 1944: (L) 1 May. San Antonio: (L) 6 May 1944, 3 June 1944, 35 April 1945, 1 June 1945. LAMAR—Camp Maxey, 1945: (L) 1 April, 3 May, 1 June, 12 July, 15 August, 10 September.

Orthopodomyia alba Baker: BEXAR—Fort Sam Houston, 1944: (T) 1♂ June. LAMAR—Camp Maxey, 1945: (L) 6 May, 15 June, 1 August.

Orthopodomyia signifera (Coquillett): LAMAR—Camp Maxey, 1945: (L) 12 June, 20 July, 21 August; (R) 1♀ August.

Psorophora discolor (Coquillett): BOWIE—Red River Ordnance, 1945: (R) 1♀ June; (T) 1♀ June, 3♀ July, 5♀ September. BROWN—Camp Bowie, 1945: (L) 1 June; (T) 1♂ 2♀ July, 1♂ August. COLLIN—Ashburn General Hospital, 1944: (R) 1♀ June. COOKE—Camp Howze, 1945: (R) 6♀ July. LAMAR—Camp Maxey, 1945: (L) 19 June, 45 July, 17 August; (R) 1♂ 2♀ June; (T) 2♂ 72♀ July, 8♂ 47♀ August. PARKER—Camp Wolters, 1945: (L) 2 May. TRAVIS—Bergstrom Field, 1945: (T) 1♀ June. WEBB—Laredo Army Air Field, 1945: (L) 2 June. WICHITA—Sheppard Field, 1945: (T) 1♂ 2♀ July, 1♀ August.

Psorophora ferox (Humboldt): WICHITA—Sheppard Field, 1945: (B) 4♀ August; (R) 2♀ July.

Psorophora horrida (Dyar and Knab): LAMAR—Camp Maxey, 1945: (B) 4♀ May, 8♀ August; (L) 1 May; (R) 8♀ May.

Psorophora howardii Coquillett: LAMAR—Camp Maxey, 1945: (L) 4 May, 1 June, 4 July.

Psorophora longipalpis Roth: BEXAR—Fort Sam Houston, 1945: (B) 5♀ April; (L) 13 March.

Psorophora signipennis (Coquillett): BROWN—Camp Bowie, 1945: (L) 24 April, 9 May, 3 June, 14 July; (T) 2♂ 7♀ April, 6♀ May, 15♂ 47♀ June, 2♂ 30♀ July, 3♂ 6♀ August. COOKE—Camp Howze, 1945: (L) 1 June; (R) 2♀ July. LAMAR—Camp Maxey, 1945: (L) 1 April, 2 May. PARKER—Camp Wolters, 1945: (B) 1♀ June; (R) 1♂ April. TRAVIS—Bergstrom Field, 1945: (L) 4 October; (T) 2♀ June. WICHITA—Sheppard Field: (B, 1945) 1♀ June; (L, 1945) 1 May, 31 July; (R, 1945) 2♂ 4♀ June, 1♀ July; (T) 1♂ 3♀ October 1944, 1♂ April 1945, 4♀ May 1945, 49♂ 63♀ June 1945, 10♂ 38♀ July 1945, 1♀ August 1945.

Uranotaenia lowii Theobald: LAMAR—Camp Maxey, 1945: (L) 1 August.

Uranotaenia sapphirina (Osten Sacken): LAMAR—Camp Maxey, 1945: (L) 4 July, 8 August; (T) 1♂ July, 1♂ 1♀ August. WICHITA—Sheppard Field, 1944: (T) 1♀ October.

Uranotaenia syntheta Dyar and Shannon: TAYLOR—Camp Barkeley, 1945: (T) 2♀ March. WICHITA—Sheppard Field, 1945: (T) 1♀ June, 1♀ July.

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NOTES ON MOSQUITOES IN NORTH AMERICA: I — NEW DISTRIBUTION RECORDS FOR EASTERN UNITED STATES DURING 1946 AND 1947

STANLEY J. CARPENTER [1]

During 1946 and 1947 the writer made the following collections of mosquitoes in the Eastern United States which constitute new locality and state records.

Aedes (Finlaya) atropalpus (Coquillett): GEORGIA — Approximately 250 larvae, July 5, 1947, from pot-holes along a three-mile course of Tallulah River near Persimmon (Rabun County), also one female attempting to bite; 67 larvae, July 10, 1947, from pot-holes along War Womans Creek near Pine Mountain (Rabun County). A collection of about 40 larvae was obtained from pot-holes along the Oconee River at Furman Shoals (Baldwin County) on March 21, 1948 by Stough *et al.* MARYLAND—Two larvae on September 7, 1947 from a pot-hole along Potomac River (Washington County) about one mile east of Harpers Ferry, West Virginia. NEW YORK—10 larvae during May, 1946 from a pot-hole along a stream near Crown Point (Essex County). NORTH CAROLINA — 49 larvae on July 9, 1947 from pot-holes along Cullasaja River between Franklin and Highlands (Macon County); 9 larvae on July 10, 1947 from pot-holes in a stream near Cashiers (Jackson County). SOUTH CAROLINA—30 larvae on July 11, 1947 from four pot-holes on the South Carolina side of Chattooga River approximately one-fourth mile north of bridge on U. S. Highway No. 76 near Longcreek (Oconee County). A new State Record. WEST VIRGINIA—22 larvae on September 7, 1947 from pot-holes along the Shenandoah River about five miles east of Charles Town (Jefferson County). New State Record. VIRGINIA—6 larvae on October 18, 1947 from a pot-hole along a creek in the George Washington National Forest near Rawley Springs.

Aedes (Ochlerotatus) aurifer (Coquillett): NEW JERSEY—One female on May 27, 1947 attempting to bite in a woodland at Menlo Park (Middlesex County); 8 larvae on May 1, 1947 (2 females reared) and 8 larvae on May 8, 1947 (1 male and 7 females reared) from cranberry bog near Lakewood (Ocean County).

Aedes (Ochlerotatus) communis (De Geer): NEW JERSEY—While collecting mosquitoes in northern New Jersey on April 22 and 27, 1947, this species was collected by the writer in two counties. A total of 36 larvae was taken from three woodland pools at Culvers Lake (Sussex County) and a similar pool near Hanks Pond (Passaic County) north of Newfoundland. Eleven males were reared from the Passaic County collection. These collections constitute a new state record for New Jersey and may represent the most southern record for the species in the eastern United States. The larvae of *A. communis* were found in the deeper portions of woodland pools in deciduous forests. In each instance the pool was approximately two and one-half to three feet in depth, filled by melting snow and the bottom was covered with leaves. It was necessary to wade into the deeper portions of the pools and collect the larvae as they surfaced.

Aedes (Ochlerotatus) fitchii (Felt and Young): NEW JERSEY—The writer has a series of reared adults of *A. fitchii* (83 males and 8 females) collected by Mr. C. A. Wilson at Butler on April 3, 1945. Additional collections made by the writer are listed as follows: 1 larva on April 28, 1947 from Vernon (Sussex County); 22 males and 19 females reared from pupae

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collected from a cranberry bog near Lakewood (Ocean County). The Lakewood, New Jersey collection appears to be the most southern record of this species in the eastern United States.

Aedes (Ochlerotatus) impiger (Walker): NEW YORK—A collection consisting of 27 larvae of this species was obtained by the writer from a woodland pool at Mount Ivy (Rockland County) in southeastern New York on April 20, 1947. This appears to be the most southern record of its occurrence in the eastern states.

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RESULTS OF THE PENNSYLVANIA MOSQUITO SURVEY FOR 1948 [1]

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The following notes have been taken entirely from insects caught in standard mosquito traps. These traps, equipped with 25 watt lamps [2] and electric fans, were generally operated every night from May 23 to September 15. The material secured from these traps was shipped daily to State College where it was completely broken down for the identification of all insects including mosquitoes. Four assistants helped to separate the material and very satisfactory results were obtained. The mosquitoes were sent weekly to the U. S. Public Health Service, New York, where they were identified by Mrs. Miriam B. Horn. Our office was supplied with lists of determinations and copies were sent to the operators of the individual light traps. This service proved accurate and prompt.

During 1948, light traps were operated in 20 localities, twelve of which were not surveyed previously, thus yielding new distributional notes. In addition records from traps operated at Coatsville were supplied by the U. S. Public Health Service and those from Tinicum were obtained from the Delaware County Mosquito Commission. Some of the localities such as the crop areas of State College and Lancaster, were not selected for mosquito records alone and therefore the catches were comparatively small. In comparing the records summarized in table 1, one should remember that most of the traps were operated from May 25 to September 15, but some were operated for only short periods when mosquitoes were expected. A fair idea of the mosquito populations can be obtained by comparing the total catches with the number of nights the traps operated and the number of nights these traps actually caught mosquitoes.

On the whole, the species taken during 1948 closely resemble those of 1947; however, there are some new records. *Aedes intrudens* Dyar, *Psorophora ferox* (Humbolt) and *Psorophora ciliata* (Fab.) which have not previously been taken in light traps in Pennsylvania, were intercepted in 1948. *Aedes intrudens* has never been taken before in Pennsylvania. Three specimens came to a light trap operated

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[2] Except one trap, see Table III.

TABLE I. Mosquitoes taken from Light Traps in Pennsylvania in 1948 4.

	Dates of collections	Presque Isle	Grove City	Racoon Creek	Indian Cr. Res.	Ohio-pile	Tion-esta	Philips-burg	State* College	Camp Barree	Cale-donia	Williams-port	Buck H. Falls	Lan-caster	Potts-town	Coats-ville	Tini-cum
No. nights operating		16	33	72	97	72	49	40	208	27	54	71	51	95	69	?	?
No. nights collecting		15	30	44	40	37	39	26	147	18	36	65	45	75	56	95	38
Anopheles quadrimaculatus Say	6/26-8/27	7	0	1	0	1	0	0	2	0	1	0	0	0	0	3	38
Anopheles crucians Wied.	6/15-8/24	0	0	0	0	0	0	0	0	0	1	0	0	1	2	14	120
Anopheles punctipennis (Say)	5/27-9/21	1	4	61	73	13	6	0	127	5	52	21	9	9	14	271	3
Anopheles walkeri Theob.	6/6-8/27	455	1	0	0	0	0	0	0	0	0	0	0	1	0	4	0
Culex pipiens Linn.	5/25-9/20	47	113	45	24	36	35	41	2072	6	98	650	198	687	219	752	3361
Culex salinarius Coq.	5/28-9/26	0	0	0	0	0	0	4	29	0	0	4	0	129	51	5748	0
Culex restuans Theob.	5/28-9/10	2	2	24	3	3	13	33	989	10	9	4	44	106	18	74	0
Culex apicalis Adams	6/5-9/15	26	22	1	3	2	0	3	26	5	1	5	20	5	5	79	0
Aedes vexans (Meig.)	5/25-9/24	532	338	45	224	36	60	13	317	8	38	38	34	79	99	218	580
Aedes canadensis (Theob.)	6/24-8/30	0	1	2	0	0	0	8	0	2	2	0	1	0	0	1	0
Aedes triseriatus (Say)	6/24-9/24	2	3	2	2	0	0	0	25	40	1	1	3	0	1	4	0
Aedes excrucians (Walk.)	7/12	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Aedes trivittatus (Coq.)	6/13-8/20	0	0	0	1	0	0	0	2	2	0	0	0	0	0	1	1
Aedes sticticus (Meig.)	6/6-7/23	7	3	0	1	2	2	0	0	4	0	0	0	0	0	1	0
Aedes cinereus Meig.	6/6-9/18	0	4	1	0	0	0	1	0	3	0	1	1	0	0	1	0
Aedes cantator Coq.	6/6-7/20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27
Aedes sollicitans (Walk.)	6/13-7/27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27
Uranotaenia sappharina (O.S.)	5/28-9/16	52	2	2	5	3	1	4	68	9	15	12	8	6	1	89	10
Mansonia perturbans Walk.	6/6-9/5	259	7	0	0	0	2	1456	5	0	0	2	2	0	0	1	0
Orthopodomia signifera (Coq.)	6/17-9/10	1	0	1	0	1	0	0	2	0	0	8	0	0	0	0	0
Theobaldia inornata (Will.)	6/2-6/12	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0
Theobaldia morsitans (Theob.)	7/21	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Theobaldia melanura Coq.	6/20-7/30	0	0	0	0	0	0	0	0	0	3	0	2	0	0	0	0
Psorophora confinnis (Arrib.)	6/30-9/14	0	0	0	0	0	0	0	1	0	3	1	0	22	1	28	8
Psorophora ciliata (Fab.)	7/12-7/22	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0
Psorophora ferox (Humbolt)	6/30-9/5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
Total		1391	500	185	337	98	120	1563	3668	94	224	748	322	1047	411	7290	4175

*Three traps, see Table III.

TABLE 2.—Light-trap Locations

Location	County	Type of area
Presque Isle	Erie	Lake, thin woods, ponds
Grove City	Mercer	Suburban, woods
Raccoon Creek	Beaver	Forest, small stream
Indian Creek	Fayette	Reservoir, woods
Ohiopyle	Fayette	Forest, large stream
Tionesta	Forest	Forest, reservoir
Philipsburg	Centre	Suburban, swamps
Bl. Moshannon	Centre	Forest, lake, swamp
State College	Centre	Crop
State College	Centre	Sewage
Camp Barree	Huntingdon	Forest, pond, stream
Martinsburg	Blair	Crop
Caledonia	Franklyn	Forest, stream
Williamsport	Lycoming	Suburban
Buck Hill Falls	Monroe	Forest, stream
Wilkes Barre	Luzerne	Suburban
Lancaster	Lancaster	Crop
Pottstown	Montgomery	Crop
Coatsville	Chester	Suburban
Kennett Square	Chester	Crop
Tinicum	Delaware	Swamp

in a forested area at Black Moshannon. Although *Psorophora ferox* was collected only once by Breland in 1937 in the vicinity of Carlisle this species is probably not as rare as sometimes believed for in 1948 it was taken at light traps at State College and Coatsville. While he found only a single larva of *Psorophora ciliata* near Carlisle, last summer this species was taken from traps operated at Ohiopyle and Indian Creek Reservoir, both in Fayette County.

The 1948 records do not reveal *Aedes stimulans* which was previously reported from Pennsylvania (Brown 1948). This is undoubtedly due to the fact that certain areas surveyed in 1947 were not studied in 1948.

Records from traps not operated for more than ten nights have not been included in table 1. These traps were run at irregular periods during the summer. They include: Black Moshannon operated for two nights and yielding the interesting record of *Aedes intrudens*; Wilkes Barre operated for ten nights with a total of 103 mosquitoes consisting chiefly of *Culex pipiens* and *Aedes vexans;* Martinsburg operated for 10 nights with a total of six mosquitoes, nothing significant; and Kennett Square operated for eight nights with a total of 148 mosquitoes, chiefly *Culex pipiens, Culex salinarius, Culex restuans* and *Aedes vexans.*

Three traps were operated in State College, one at the sewage plant and two on the college farms. The catches from these traps, which are summarized in Table 3, show the effect of location on mosquito populations. At the sewage plant, which is scarcely a mile from the college farms, a trap was hung on a pine tree in a small ravine adjacent to a somewhat wooded area and adjoining a small stream and a pond. This was an ideal location for mosquito catches and proved to be excellent for trapping insects in general. The trap indicated as No. 1, operated on the college farms, was hung on a pear tree in an exposed location with extensive fields of corn and clover nearby and fruit orchards and a wooded area less than 1000 feet from the trap. The trap indicated as No. 2, also operated on the college farms, was hung on a black walnut tree in an exposed location adjacent to corn and clover fields and orchards but was more distant from the wooded area mentioned above. The mosquito catches from location No. 1 have been divided into two periods, May 25 to August 31 and from September 1 to September 15. This was done so that catches from the standard mosquito trap with electric fan and a 25 watt lamp could be compared with the Minnesota type trap with no electric fan and with a 100 watt lamp.

Naturally the mosquito catches were much greater from the trap placed at the sewage plant although this trap operated for fewer nights than the traps situated on the college farms. However, *Aedes triseriatus* was taken more frequently in the trap on the college farms. This species is known to breed in tree holes and the adults generally do not wander far from the woods which they inhabit.

TABLE 3.—Mosquito Catches from Three Traps * Operated in State College

	Location of traps			
	Sewage plant	*College farms 1*	*College farms 1*	*College farms 2*
No. nights operating	81	96	14	17
No. nights catching	71	51	7	15
Wattage of lamp	25	25	25	100†
Period of operation	May 25 to Sept. 15	May 25 to Aug. 31	Sept. 1 to Sept. 15	Sept. 1 to Sept. 19
Culex pipiens	1492	23	11	46
Culex salinarius	29	0	0	0
Culex restuans	912	50	2	25
Culex apicalis	21	1	0	4
Anopheles punctipennis	113	2	6	6
Aedes vexans	257	38	12	10
Aedes triseriatus	2	20	0	1
Uranotaenia sapphirina	46	5	1	16
Totals	2872	139	32	108

* Only the more abundant species are considered.

† This is the Minnesota type trap without electric fan; the other records in this table were taken from standard mosquito traps with electric fan.

Although the period of comparison of the operation of the Minnesota type trap with the standard mosquito trap was short, the figures indicate a higher catch for the former.

SUMMARY

The operation of light traps throughout Pennsylvania for two consecutive years and additional mosquito studies make it possible to draw some general conclusions. *Culex pipiens* Linn., and *Aedes vexans* (Meig.) are the most common and widely distributed species in Pennsylvania occurring from early spring to late fall. *Uranotaenia sapphirina* (O.S.) occurs generally throughout the State but is seldom common and is not an important species. *Culex restuans* Theobald is another common and widely distributed species. Certain species are common only where proper breeding conditions exist. *Anopheles crucians* Wied. is common only in the eastern part of the State. *Anopheles walkeri* Theobald is abundant only at Presque Isle. It is very evident that *Mansonia perturbans* Walk. predominates at Philipsburg although it occurs to some extent at Presque Isle. *Anopheles quadrimaculatus* Say has been taken in small numbers from seven widely separated parts of the State.

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AN ANNOTATED LIST OF THE MOSQUITOES OF NEW YORK [1]

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The mosquitoes of New York have been the subject of scientific study for many years. Among the early papers containing data on mosquito distribution in this state are those of Dyar(1), Johannsen (2), and Felt(3), which were published in 1902, 1903, and 1904, respectively. In the latter publication definite references were made to 30 species of mosquitoes from New York and eight others from neighboring states. In 1917 the extensive monograph of Howard, Dyar, and Knab(4) appeared. This work summarized most of the available distributional data for the mosquitoes of North America and included records of 33 species from New York. A list of the mosquitoes of New York, prepared by Dr. Robert Matheson, was published in 1926(5). This list, which included 43 species, was based on the Cornell University collection, Dr. E. P. Felt's collection, and published records of other workers. The works of Richards(6) and Matheson(7) added four species, and the present paper records five others which were previously unknown from the State. These records bring the total number of species of mosquitoes known from New York to fifty-two.

The data used in compiling the present list of species have been assembled from the Cornell University mosquito collection, from collections made by the writers and other U. S. Public Health Service personnel (1942–45), from collections of the U. S. Army Sanitary Corps (1944–45), and from available literature records. The species herein reported for the first time are *Aedes flavescens, A. mitchellae, A. spencerii, Anopheles bradleyi,* and *Psorophora varipes.*

Most of the original records reported are based on collections made in and around Army and Navy installations. In addition, a considerable number of miscellaneous collections were made in various sections of the state as the opportunities presented themselves. Altogether, the authors have identified mosquitoes collected from 46 localities in 23 of the 62 counties in the state. Additional records from the Cornell University collection and from the literature increase these figures to 197 localities and 49 counties.

The species of mosquitoes now known to occur in New York are given in alphabetical order in the following list. The records are based upon identifications made by Service workers unless otherwise indicated. Under each species are included the localities where it has been taken, the types of collections, its abundance, and the earliest and latest months during which it was collected. The locality records are listed alphabetically under the counties in which they occur. An asterisk (*) preceding the name of a species indicates a new state record.

Symbols are used to indicate the type of collections (when known) as follows: (B)—biting; (L)—larval; (R)—adults reared from larvae or pupae; (S)—diurnal resting stations; and (T)—light traps. Density ratings are based on the maximum number of specimens taken in a locality in a single collection. A species is generally considered to be rare in a given locality at a given time if no more than

[1] It is desired to express our appreciation to Dr. Robert Matheson of Cornell University for making available to us his collection of mosquitoes of New York and for generous assistance in many other ways. We are also indebted to Mr. G. H. Bradley of the Communicable Disease Center, Atlanta, Georgia for many helpful criticisms. Most of the routine identifications and rearings were performed by Mrs. Miriam B. Horn, Mrs. Mary F. Rosegay, and Mr. Howard Schiff.

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nine specimens were found in any one collection, common if from 10 to 99 specimens were taken in a single collection, and abundant if 100 or more were taken in a single collection. For some of the rarer species the exact number of specimens as well as the specific dates of collection are given. General statements relative to the abundance of species in the state are based on more than three years' experience in collecting mosquitoes in this and neighboring states.

Aedes atlanticus Dyar and Knab: This species occurs principally in the Southern states. The only New York records are by Richards(6) who collected a single larva in Nassau County at Island Park on April 17, 1937, and by Felt who reported it from Richmond County (Staten Island) according to Howard, Dyar, and Knab(4).

Aedes atropalpus (Coquillett): Breeds in rock holes along streams and waterfalls and may be found in considerable numbers where such breeding areas occur. Clinton County: Plattsburg, July (8). Essex County: Ausable Chasm, (B,L), common, Aug. Franklin County: Tupper Lake, Aug. (4). Greene County; Haines Falls, 1 male, Sept. 1, 1936 (9). Herkimer County: Old Forge, Aug. (8). Jefferson County: Deferiet (8). Oneida County: Forestport (8). Queens County: New York City, rare, July. Tompkins County: McLean, July (8). Westchester County: New Rochelle, (L,R,S), common, June-Aug.

Aedes aurifer (Coquillett): According to Matheson(7) this species occurs throughout northeastern United States and is abundant in certain sections of New York. The writers have taken it in numbers only in Schuyler County at Cayuta Lake and in Orange County at West Point. Cayuga County: North Fairhaven, June–July, (8). Port Byron, (B), 1 female, July 9, 1944. Dutchess County: Hyde Park, (B), rare, July–Aug. Essex County: Elizabethtown, June (8). Niagara County: Fort Niagara, rare, June–July. Oneida County: Utica, (S), rare, June. Onondaga County: Baldwinsville, May (8). Syracuse, June (8). Orange County: West Point, (B,S), common, July–Aug. Queens County: New York City, a single male. Schuyler County: Cayuta Lake, (B,L), abundant, May–June (8, in part). Waneta Lake, June–July, (8). Suffolk County: Yaphank, (B,S), rare, June. Tompkins County: Ringwood, May, (8). Wayne County: Sodus Point, June–July, (8).

Aedes canadensis (Theobald). One of the two most common species of *Aedes* in New York. It is most abundant in early spring and is a very annoying pest especially in wooded areas. It occurs from early March until October, although it becomes much less common in late summer and fall. Reported from 56 localities in the following counties: Albany, Cayuga, Clinton, Dutchess, Essex, Franklin, Hamilton, Herkimer, Kings, Lawrence, Monroe, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Queens, Rensselaer, Richmond, Rockland, Seneca, Schuyler, Steuben, Suffolk, Tompkins, Wayne, and Westchester.

Aedes cantator (Coquillett). A severe pest along the coastal areas of New York where it breeds principally in brackish marshes. Dr. Matheson has also collected it in inland areas in Onondaga County around Syracuse and in Tompkins County around Ithaca where it was breeding in salt pools. It has been found in greatest numbers at Staten Island in Richmond County. Kings County: Brooklyn, (T), common, May–Aug. Jamaica Bay, (L), June–Sept., (6), Sheepshead Bay, June–July, (8). Nassau County: Baldwin, (B), rare, Aug. Bellmore, (6). Freeport, (6). Hempstead, (S,T), rare, June–Oct. Hewlett Neck, (6). Island Park, (6). Jones Beach, June–Sept., (6). Lido Beach, (6). Massapequa, (6). Merrick, June–Sept., (6). Oceanside, (6). Seaford, (6). Woodmere, Sept., (8). Wantagh, (6). Oneida County: Rome, (B), rare, June–July. Utica, (B), rare, June–July. Onondaga County: Syracuse, (L), (8). Orange County: West Point,

(S,T), rare, June–Aug. New York County: Governors Island, (S,T), rare, May–Oct. Queens County: Flushing, (B, L,R,S,T), common, March–Oct. New York City, common, Apr.–Aug. Richmond County: Staten Island, (B,L,R,S,T), abundant, Apr.–Oct. Rockland County: Orangeburg, (S,T), abundant, May–Sept. Suffolk County: Babylon, July, (4). Bellport, (4). Center Moriches, Sept., (4). Cold Spring Harbor, Apr.–May, (8). Northport, July, (4). Riverhead, Sept., (8). Suffolk County, July–Aug., (8). Yaphank, (B,S,T), rare. Tompkins County: Ithaca, June–July, (8).

Aedes cinereus Meigen: This species has been found sparingly throughout most of the State. Matheson(7) states that in central New York it breeds in shallow woodland pools with a dense floor of decaying leaves. The females are severe biters and have been especially noted in woodland areas. Albany County: Karner, May–June, (8). Cayuga County: North Fairhaven, June, (8). Port Byron, (B), rare, July. Chemung County: Elmira, July, (8). Clinton County: Plattsburg, (B), rare, Apr.–Sept., (4, in part). Dutchess County: Green Haven, (B), rare, June–July. Pawling, (L,R), rare, May. Poughkeepsie, May, (8). Erie County: Buffalo, Sept.–Nov. (5). Essex County: Elizabethtown, May–July, (8). Lake Placid, (B,S), rare, July–Aug. Franklin County: Duck Lake, June, (8). Tupper Lake, Aug., (8). Herkimer County: Big Moose, June, (8). Old Forge, Aug., (8). Nassau County: Hempstead, (T), rare, Aug. New York County: Governors Island, (B,T), rare, July–Aug. Niagara County: Fort Niagara, (L,S,T), rare, May–Aug. Oneida County: Rome, (B), rare, June–Aug. Utica, (B,L,S), rare, June–Aug. Onondaga County: Cross Lake, July, (8). Tully Lakes, July, (8). Ontario County: Geneva, (B), common, June. Orange County: West Point, (B, L,S,T), rare, Apr.–Sept. Queens County: Flushing, (T), rare, Aug. New York City, rare, Apr.–June. Rensselaer County: Nassau, May, (5). Richmond County: Staten Island, (B,L,T), rare, May–Sept. Rockland County: Orangeburg, (B,S,T), rare, June–Aug. Schuyler County: Alpine Junction, July, (8). Cayuta Lake, (B), May–June, (8, in part). Waneta Lake, July, (8). Watkins Glen, May–July, (8). Steuben County: Bath, May–June, (8). Suffolk County: Suffolk Co., July–Aug., (8). Yaphank, (B,L,T), rare, July–Sept. Tioga County: Apalachin, July, (8). Owego, July, (8). Tompkins County: Freeville, (8). Ithaca, Apr.–Aug., (8). McLean, May–Aug., (8). Ringwood, May, (8). Wayne County: Sodus Point, June–Aug., (5). Westchester County: Dobbs Ferry, (L,R), rare, March.

Aedes communis (De Geer): The only specimens of *A. communis,* which have been identified by the writers, were collected in Essex County at Lake Placid by Lt. Edwin A. Kass. These collections indicate the presence of larvae in that locality in July and of adults in July and early August. A number of other localities are represented in the Cornell University collection. Albany County: Delmar, Aug., (8). Karner, May, (4). Clinton County: Plattsburg, Apr., (4). Essex County: Elizabethtown, May–June, (8). Lake Placid (B,L), 1 larva, July 26, 1945; 7 females, July 12, 1945; 5 females, July 20, 1945; 5 females, Aug. 2, 1945, Lt. Edwin A. Kass. Franklin County: Saranac Inn, July, (8). Herkimer County: Big Moose, June, (8). Old Forge, June, (8). Rensselaer County: Nassau, May, (8). Schuyler County: Cayuta Lake, (8). Tompkins County: McLean, May, (8). Ringwood, Apr.–May, (8).

Aedes diantaeus Howard, Dyar and Knab: An extremely rare species in New York. The writers have seen only two larvae which were collected in Essex County at Lake Placid by Lt. Edwin A. Kass. According to Matheson,(7) this species breeds almost exclusively in cold, shaded pools in forested areas, particularly coniferous forests. Essex County: Lake Placid, (L), 2, July 26, 1945, Lt. Edwin A. Kass. Tompkins County: Ringwood, June, (8).

Aedes dorsalis (Meigen): Breeds in a variety of habitats including both salt and fresh water marshes. It appears to be rather rare in New York as it has been found only in small numbers though in widely separated localities. Albany County: Albany, Aug.–Sept., (8). Niagara County: Fort Niagara, (S), 1 female, May 28, 1945; 1 male, Sept. 6, 1945 (det. genitalia). Oneida County: Utica, (T), 1 male, Sept. 12, 1945 (det. genitalia). Onondaga County: Baldwinsville, May, (8). Syracuse, (B,S), 1 female, Aug. 14, 1945; 6 females, Aug. 17–18, 1945, May–Sept., (8). Queens County: Flushing, (B), rare, June. Rockland County: Orangeburg, (S), 1 male, July 8, 1945, (det. genitalia). Tompkins County: Ithaca, May–Aug., (8).

Aedes excrucians (Walker): The distribution and abundance of *A. excrucians* are rather difficult to determine accurately from our data since in many cases it has been impossible to separate females of this species from those of *A. fitchii* and *A. stimulans*. The following records, except when based on reared specimens or male genitalia, must therefore be regarded as tentative. Albany County: Albany, May–June, (8). Delmar, May, (8). Karner, May–July, (8). Voorheesville, July, (8). Cattaraugus County: Salamanca, June, (8). Cayuga County: North Fairhaven, July, (8). Port Byron, (B), rare, July. Chemung County: Elmira, July, (8). Clinton County: Plattsburg, (B), rare, Apr.–Aug. (4, in part). Dutchess County: Green Haven, (B,S), rare, June–July. Hyde Park, (B), rare, July–Aug. Essex County: Elizabethtown, May, (8). Franklin County: Duck Lake, June, (8). Saranac Inn, July, (8). Greene County: Onteora Club, July, (5). Herkimer County: Herkimer, Aug., (8). Old Forge, Aug., (8). Kings County: Sheepshead Bay, June–July, (8). Monroe County: Honeoye Falls, June, (8). Niagara County: Fort Niagara, (L,R,S), rare, May–June. Niagara Falls, (B,S), rare, June–Aug. Olcott, June, (8) Oneida County: Rome, (B), common, July–Aug. Trenton Falls, June, (8). Utica, (B,S,T), rare, June–July. Onondaga County: Syracuse, June–Aug., (8). Orange County: West Point, (B,L,T), rare, May–Aug. Queens County: Forest Park, June, (5). New York City, June, (8). Rensselaer County: Rensselaer, May, (5). Richmond County: Staten Island, (B,L,T), rare, Apr.–Aug. Rockland County: Orangeburg, (S,T), rare, May–Aug., (2 males det. genitalia). Saratoga County: Victory Mills, May, (8). Schuyler County: Alpine Junction, July, (8). Cayuta Lake, May, (8). Waneta Lake, July, (8). Watkins Glen, May–Aug., (8). Seneca County: Romulus, (B), rare, June. Seneca Falls, July, (8). Steuben County: Bath, May, (8). Suffolk County: Yaphank, (B,T), rare, May–July. Tompkins County: Cayuga Lake, May, (8). Ithaca, May–Sept., (8). McLean, May–July, (5). Ringwood, May–June, (8). Warren County: Lake George, Aug., (5). Washington County: Pearl Point, Aug., (8).

Aedes fitchii (Felt and Young): This species breeds in early spring pools where it often occurs in great numbers. Its habits are similar to those of *A. excrucians* and *A. stimulans* with which it is often associated. It is often difficult to distinguish *A. fitchii* from *A. excrucians* and *A. stimulans* and the following records, except when based on genitalia or larvae, must be regarded as tentative. Available information indicates that it is rather widely distributed in the State. Albany County: Delmar, May, (8). Karner, May–July, (8). Meadowdale, May, (8). Thacher Park, May, (8). Cattaraugus County: Salamanca, June, (8). Cayuga County: Atwaters, July, (8). Port Byron, (B), rare, June–July. Clinton County: Plattsburg, (B,S), rare, Apr.–Aug., (4, in part). Columbia County: Niverville, June, (8). Dutchess County: Green Haven, (B,S), rare, June–July, (one male det. genitalia). Hyde Park, (B), rare, June–Aug. Poughkeepsie, May, (8). Essex County: Elizabethtown, May–June, (8). Keene Valley, Aug., (8). Franklin County: Duck Lake, June, (8).

Greene County: Onteora Club, June–Aug., (5). Hamilton County: Wells, July, (8). Herkimer County: Herkimer, Aug., (8). Newport, June–Aug., (8). Kings County: Brooklyn, (T), rare, June. New York County: Governors Island, (T), rare, June. Niagara County: Fort Niagara, (S), rare, June–July. Niagara Falls, (B,S), common, June–Aug. Oneida County: Rome, (B), common, June–Aug. Trenton Falls, June, (8). Utica, (B,S), rare, June–Aug. Onondaga County: Jordan, July, (8). Syracuse, July, (8). Tully Lakes, July, (8). Ontario County: Geneva, (B), rare, June. Queens County: New York City, a single male, (det. genitalia). Rensselaer County: Nassau, May–June, (8). Richmond County: Staten Island, (B,T), rare, June. Rockland County: Orangeburg, (T), rare, May–Aug. Saratoga County: Victory Mills, May, (8). Seneca County: Romulus, (T), rare, June. Seneca Falls, July, (8). Schuyler County: Watkins Glen, May–Aug., (8). Suffolk County: Riverhead, June, (8). Yaphank, (L), rare, May. Tompkins County: Ithaca, June–July, (8). Lick Brook, May, (8). McLean, May–Aug., (8). Ringwood, May, (8). Wayne County: Sodus Point, June, (8). Westchester County: North Salem, July, (8).

* *Aedes flavescens* (Muller): Previously known to be distributed from Ontario and Michigan, westward throughout the great plains, south to Northern Illinois and Iowa and north to Hudson Bay and Alaska (7). A single larva which was collected in Essex County at Lake Placid, New York, July 26, 1945 by Lt. Edwin A. Kass has been identified by Dr. Matheson as *A. flavescens*. Dr. Matheson (personal communication) states that he has two previous records of this species from New York which have not been published. One, a male, was collected in Tompkins County at Ithaca on May 18, 1913 and the other, also a male, was taken by Dr. E. P. Felt in Albany County at Albany on June 11, 1927.

Aedes grossbecki Dyar and Knab: An extremely rare species which is known from only three localities in the State. Our collections include two males, both taken from southeastern New York in August. Dr. Matheson reports it from Tompkins County at Ithaca. Nassau County: Hempstead, (T), 1 male, Aug. 17, 1945, (det. genitalia), Rockland County: Orangeburg, (T), 1 male, Aug. 5, 1945, (det. genitalia). Tompkins County: Ithaca, (7).

Aedes impiger (Walker): A rare species in the United States. The authors have not identified it from New York but it has been previously reported from three localities. Clinton County: Plattsburg, April, (10). Essex County: Elizabethtown, Apr., (5). Schuyler County: Cayuta Lake, May, (8).

Aedes implacabilis (Walker): The writers have been unable to separate the females of this species fom those of *A. punctor*. The following records, except when based on larvae or male genitalia, must therefore be regarded as being either *A. implacabilis* or *A. punctor*. Cayuga County: Port Byron, (B), 1 female, June 21, 1945. Clinton County: Plattsburg, (B), 6 females, June 14, 1945, Lt. J. J. Wurdack; (L), April 24, 1905, (4). Essex County: Chapel Pond, June, (5). Elizabethtown, June, (5). Greene County: Onteora Club, June, (5). Orange County: West Point, (T), rare, May. Ontario County: Geneva, (B), 2 females, June 20, 1945. Queens County: New York City, rare, (det. male genitalia). Rensselaer County: Nassau, May, (5). Rockland County: Orangeburg, (T), rare, May–June. Schuyler County: Cayuta Lake, (L), April, (8). Tompkins County: Ithaca, (L), April, (8). McLean, (5). Ringwood, May, (5).

Aedes intrudens Dyar: Matheson(7) considers this species to be common in New York and states that it breeds in woodland pools filled by melting snows and early spring rains. Our collections have revealed relatively few positively identified specimens and most of the following records are from the Cornell Uni-

versity collection. Albany County: Albany, May, (8). Delmar, May, (8). Karner, March–May, (8). Normanskill, May, (8). Clinton County: Plattsburg, (S), rare, June. Dutchess County: Hyde Park, (B), rare, June. Pawling, (S), rare, June–July. Essex County: Chapel Pond, June, (8). Elizabethtown, Apr.–June, (8). Franklin County: Duck Lake, June, (8). Saranac Inn, July, (8). Greene County: Onteora Club, June, (5). Herkimer County: Big Moose, June, (8). Old Forge, June, (8). Jefferson County: Watertown, (S), rare, June. New York County: Governors Island, (T), rare, June. Oneida County: Utica, (S), rare, June. Onondaga County: Tully Lake, July–Aug., (8). Orange County: West Point, (B,S), rare, May–July. Rensselaer County: Nassau, May–June, (8). Richmond County: Staten Island, (B,L,T), common, May–June. Rockland County: Orangeburg, (B,S,T), rare, May–July. Suffolk County: Suffolk County, July, (8). Yaphank, (B, S), rare, May–June. Tompkins County: Ithaca, Apr.–July, (8). Ringwood, May–Oct., (8). Wayne County: Sodus Point, July, (8).

* *Aedes mitchellae* (Dyar): A common species in southeastern United States but has not been previously taken in New York. The specimens upon which this record is based were collected by Lt. Morris Silverman near Halloran General Hospital, Richmond County, Staten Island, New York. Richmond County: Staten Island, (L,T), 1 female, May 3, 1944; 6 larvae, June 23, 1944.

Aedes punctor (Kirby): As previously stated, the writers have been unable to separate the females of this species from those of *A. implacabilis* and therefore can give little information regarding its distribution and abundance. A single male has been identified from Richmond County at Staten Island and a few other records are available from the Cornell University collection and from the literature. Albany County: Karner, May–June, (8). Meadowdale, May, (8). Thacher Park, May, (8). Voorheesville, May, (8). Cattaraugus County: Salamanca, June, (8). Cayuga County: North Fairhaven, July, (8). Clinton County: Peru, June, (8). Plattsburg, April, (10). Essex County: Chapel Pond, June, (8). Elizabethtown, May–July, (8). Marcy Pond, June, (8). Franklin County: Duck Lake, June, (8). Saranac Inn, July, (8). Herkimer County: Big Moose, June, (8). Old Forge, June–Aug., (8). Rensselaer County: Nassau, May, (8). Richmond County: Staten Island, (T), 1 male, Aug. 6, 1945, det. genitalia. Tompkins County: Ithaca, Apr.–Sept., (8). McLean, May, (8). Ringwood, May–June, (8). Washington County: Thomson, May, (8).

Aedes riparius Dyar and Knab: The writers have not encountered this species but Matheson(7) states that he has one larva which was taken in Onondaga County near Syracuse.

Aedes sollicitans (Walker): An important pest species along the coastal regions of the State where it breeds abundantly in the salt marshes. It has also been taken about the salt pools in Onondaga County at Syracuse (7). Dutchess County: Pawling, (T), 2 females, July 29, 1945. Kings County: Brooklyn, (S,T), common, May–Sept. Sheepshead Bay, June–Aug., (8). Nassau County: Baldwin, (B), common, Aug. Center Island, May, (4). Farmingdale, July, (8). Freeport, (6). Hempstead, (S,T), rare, June–Sept. Island Park, (6). Jones Beach, (6). Lawrence, (6). Merrick, (6). Oceanside, (6). Woodmere, Sept., (8). New York County: Governors Island, (B,S,T), rare, May–Oct. Onondaga County: Syracuse, June–Aug., (8). Orange County: West Point, (T), 1 female, July 19, 1945. Queens County: Flushing, (B,S,T), common May–Oct. Forest Park, June–Sept., (5), Jamaica, (L,R), abundant, Sept. New York City, abundant, May–Oct. Richmond County: Staten Island, (B,L,S,T), abundant, May–Oct. Rockland County: Orangeburg, (L,T), common, June–Sept. Suffolk County: Bellport, Aug., (4). Brentwood, (B,S), rare, July–Aug. Center Moriches, Sept., (4). Cold Spring Harbor, July, (4).

Hog Point, Aug., (8). Lloyd's Neck, Oct. (4). Northport, July, (4). Patchogue, June, (8). Riverhead, June–Sept., (8). Sag Harbor, July, (4). Suffolk County, July–Aug., (8). Wyandach, July, (6). Yaphank, (B,S,T), common, June–Oct.

* *Aedes spencerii* (Theobald): According to Matheson(7), *A. spencerii* is the dominant species of the prairies. It has been previously reported from the plains and mountains of Utah, Idaho, and Wyoming, east to Illinois and Michigan. A single female from Lake Placid (Essex County), New York constitutes the only known record of the species from the eastern states. This mosquito was taken in a biting collection at the edge of a fir-spruce forest on July 26, 1945 by Lt. Edwin A. Kass. The specimen has been deposited in the Cornell University collection.

Aedes sticticus (Meigen): A single brooded floodwater species which is widely distributed over eastern United States and Canada. It often proves to be a very severe pest in New York. It was observed in tremendous numbers at Howland's Island near Port Byron on June 21, 1945, where it proved to be such a fierce biter that it was almost impossible to continue with outdoor activities. Liberal applications of the repellent dimethylphthalate afforded little protection from this mosquito. Albany County: Karner, June, (8). Cayuga County: Port Byron, (B,S), abundant, June–July. Chemung County: Elmira, July, (8). Clinton County: Plattsburg, (B,S), rare, June. Dutchess County: Pawling, (S), rare, June. Jefferson County: Watertown, (S), common, June. Kings County: Sheepshead Bay, July, (8). Niagara County: Fort Niagara, (L,R,S), rare, May–June. Onondaga County: Cross Lake, July, (8). Jordan, July, (8). Ontario County: Geneva, (B), common, June. Orange County: West Point, (B,S,T), common, May–Sept. Richmond County: Staten Island, (T), rare, July. Rockland County: Orangeburg, (S,T), common, June–Aug. Tioga County: Apalachin, July, (8). Tompkins County: Ithaca, June–Sept., (8). Ringwood, June, (8). Washington County: Easton, May, (8).

Aedes stimulans (Walker): One of the most abundant and annoying woodland species of New York. It occurs principally during spring and early summer and seems to be more abundant than the closely related *A. excrucians* and *A. fitchii*. Albany County: Delmar, May, (8). Karner, May–June, (8). Cayuga County: Atwaters, July, (8). Port Byron, (B,S), common, June–July. Chautauqua County: Westfield, June, (5). Clinton County: Plattsburg, (B,S), rare, June; Apr., (4). Columbia County: Niverville, June, (8). Dutchess County: Green Haven, (B,S), rare, June–July. Hyde Park, (B,S), common, May–Aug. Pawling, (S), rare, June. Poughkeepsie, May, (8). Franklin County: Duck Lake, June, (8). Genesee County: Batavia, June, (8). Hamilton County: Piseco Lake, Aug., (8). Wells, July, (8). Herkimer County: Newport, June, (8). West Winfield, June, (8). New York County: Governors Island, (B,T), rare, July–Aug. Niagara County: Fort Niagara, (S), common, May–Aug., one male det. genitalia. Niagara Falls, (B,S), common, June–Aug. Olcott, June, (8). Oneida County: Rome, (B), common, July-Aug. Utica, (B,S,T), common, June-Aug. Onondaga County: Jordan, July, (8). Syracuse, June, (8). Tully Lakes, July, (8). Ontario County: Geneva, (B), common, June. Orange County: West Point, (B), rare, July. Queens County: New York City, rare, May–July. Rensselaer County: Nassau, June, (8). Richmond County: Staten Island, (B,LMS,T), rare, Apr.–July (one male determined genitalia). Rockland County: Orangeburg, (S,T), rare, June–July (one male determined by genitalia). Schuyler County: Alpine Junction, July, (8). Cayuta Lake, May–July, (8). Waneta Lake, July, (8). Watkins Glen, July, (8). Seneca County: Romulus, (B,S,T), common, June–July. Seneca Falls, July, (8). Steuben County: Bradford, (L), (8). Suffolk County: Amagansett, (10). Bellport, (10). Yap-

hank, (B), rare, June. Tioga County: Apalachin, July, (8). Owego, July, (8). Tompkins County: Ithaca, Apr.–July, (8). McLean, May–July, (8). Ringwood, Apr.–Aug., (5). Washington County: Easton, May, (8). Wayne County: Sodus Point, June, (8).

Aedes taeniorhynchus (Wiedemann): This is the small salt marsh mosquito which is an important pest of the South Atlantic coastal region. It occurs sparingly along the coast of southeastern New York and is seldom present in sufficient numbers to be of much importance. Kings County: Sheepshead Bay, Aug., (8). Nassau County: Merrick, Aug.–Sept. (6). Woodmere, Aug.–Sept., (6). New York County: Governors Island, (T), rare, July. Queens County: Flushing, (T), rare, Sept. Forest Park, (5). New York City, rare, June–Aug. Richmond County: Staten Island, (B,L,T), rare, June–Oct. Rockland County: Orangeburg, (T), 1 male, Aug. 4, 1945. Suffolk County: Amagansett, (1). Babylon, July, (4). Bellport, Aug., (4). Halfway Hollow Hills, June, (8). Hog Point, Aug., (8). Sag Harbor, (4). Suffolk County, July–Aug., (8).

Aedes trichurus (Dyar): The authors have but rarely encountered this species in New York. It has been taken from several localities by Dr. Matheson and most of the following records are from his collection. Albany County: Albany, May, (8). Delmar, May, (8). Karner, May, (8). Normanskill, May, (8). Clinton County: Peru, June, (8). Plattsburg, Apr., (4); (B), 1 female, June 8, 1945, Lt. J. J. Wurdack. Dutchess County: Hyde Park, (B), rare, June. Essex County: Center, May, (8). Elizabethtown, May, (8). Herkimer County: Herkimer, Aug., (8). Old Forge, June–Aug., (8). Rensselaer County: Nassau, May, (8). Schuyler County: Alpine, common, Apr., (8). Watkins Glen, Apr., (8). Tompkins County: Ithaca, Apr.–May, (8). Ringwood, Apr.–June, (8).

Aedes triseriatus (Say): A common and widely distributed species which breeds principally in tree holes. The females bite readily but apparently do not fly far from their breeding places. Albany County: Albany, Aug., (8). Karner, May–Aug., (8). Cayuga County: North Fairhaven, July, (8). Dutchess County: Hyde Park, (T), rare, Aug.–Sept. Erie County: Erie County, June–Aug., (5). Essex County: Elizabethtown, July–Aug., (8). Lake Placid, (B), 1 female, Aug. 22, 1945. Herkimer County: Old Forge, Aug., (8). Nassau County: Hempstead, (T), rare, July–Sept. Lawrence, (L), Oct., (6). Niagara County: Fort Niagara, (S,T), rare, July–Sept. Oneida County: Rome, (B), common, June–Aug. Utica, (B,S,T). Onondaga County: Syracuse, June, (8). Orange County: Michigan Hollow, July, (8). Tuxedo, July, (9). West Point, (B,L,S,T), common, Apr.–Sept. Putnam County: Lake Mahopac, July, (8). Queens County: New York City, rare, June–Sept. Queens Village, (B), rare, Aug. Richmond County: Staten Island, (B,S,T), rare, June–Sept. Rockland County: Orangeburg, (B,S,T), rare, June–Sept. Ramapo, Oct., (8). Schuyler County: Cayuta Lake, (B,L,R), abundant, June–July. Watkins Glen, July, (8). Seneca County: Romulus, (S,T), rare, Sept. Suffolk County: Cold Spring Harbor, June, (8). Halfway Hollow Hills, July, (8). Suffolk County, July–Aug., (8). Wyandach, July, (8). Yaphank, July, (8). Tompkins County: Ithaca, June–Sept., (8). McLean, June–July, (8). Wayne County: Sodus Point, July, (8).

Aedes trivittatus (Coquillett): This species is known from a considerable number of localities in New York, though it has seldom been found in large numbers. According to Matheson (7) it was very common in central New York during the floods of 1935 where it proved to be a vicious biter. Albany County: Albany, June, (8). Karner, June, (8). Chemung County: Elmira, July, (8). Clinton County: Plattsburg, (B,S), rare, June-Sept. Nassau County: Hempstead, (T), rare, Aug. New York County: Governors Island, (T), rare, Aug. Niagara County: Fort Niagara, (S), rare, June. Oneida

County: Utica, (B,T), rare, Aug. Orange County: Tuxedo, July, (9). West Point, (B,T), rare, June-Sept. (3 males determined genitalia). Queens County: Flushing, (B), rare, July. New York City, rare, July. Queens Village, (B), common, July. Richmond County: Staten Island, (B,S), rare, June–Aug. Rockland County: Orangeburg, (S,T), rare, June–Aug. (1 male determined genitalia). Seneca County: Romulus, (T), rare, July. Steuben County: Bath, July, (8). Suffolk County: Yaphank, (T), rare, Aug. Tioga County: Apalachin, July, (8). Tompkins County: Ithaca, June–Sept., (8). Taughannock Falls, Sept., (8).

Aedes vexans (Meigen): This is the most abundant species of *Aedes* in New York. It is one of the most important of all pest mosquitoes as it is a vicious biter and a strong flyer. It will breed in almost any type of water and often occurs in fabulous numbers in roadside pools. Extensive collections indicate the breeding of *A. vexans* from March through October. It has been taken from 58 localities from the following counties: Albany, Cayuga, Clinton, Dutchess, Essex, Franklin, Hamilton, Herkimer, Kings, Monroe, Nassau, Niagara, Oneida, Onondaga, Ontario, Orange, Queens, Rensselaer, Richmond, Rockland, Schoharie, Schuyler, Seneca, Steuben, St. Lawrence, Suffolk, Tompkins, Ulster, Wayne, and Westchester.

Anopheles barberi Coquillett: Only two specimens of this small tree-hole-breeding anopheline were taken in the state. Matheson(7) states that it occurs commonly in the tree holes about Ithaca (Tompkins County). It is probable that a careful search would prove this species to be more widely distributed in New York than present records indicate. Orange County: West Point, (S), 1 female, under old smoke house, Aug., 1944. Rockland County: Orangeburg, (S), 1 male, under barracks, Aug. 16, 1944. Tompkins County: Ithaca, (L), common, July–Oct., (8).

* *Anopheles bradleyi* King: Until recently *A. bradleyi* was considered to be a brackish-water variety of *A. crucians* which it resembles closely in the adult stage. Larvae of *A. bradleyi* and *A. crucians* can, however, be readily distinguished, and many workers in this group now consider them to be distinct species. *A. bradleyi* has been known from the Atlantic and Gulf Coast from Maryland to Vera Cruz, Mexico. It was recently reported from more northern Atlantic coastal areas by the writers(11). At that time, definite larval records were available from southern New Jersey and tentative adult records from southeastern New York, New Jersey and Delaware. During the 1945 season two collections of larvae of *A. bradleyi* were made from slightly brackish coastal marshes near Idlewild Airport, Jamaica, Long Island, New York. The first of these collections was made on September 7, 1945, at which time 13 *A. bradleyi* larvae were taken. They were found in association with three larvae of *A. punctipennis* and many *Culex salinarius*. On Oct. 3, 1945, 32 *A. bradleyi* larvae were collected along with 16 larvae of *A. punctipennis*, 4 larvae of *A. quadrimaculatus* and a great number of *C. salinarius*. In both collections all anophelines were identified from living larvae which were then isolated and reared for confirmation.

Anopheles crucians Wiedemann: Ranges from Massachusetts to Texas, being most abundant in the southeastern states. It is a fairly common species in southeastern New York and has been taken as far upstate as West Point. Kings County: Brooklyn, (T), rare, June. Nassau County: Farmingdale, Aug., (6). Hempstead, (T), common, June–Oct. New York County: Governors Island, (T), rare, June–Oct. Orange County: West Point, (L,S,T), common May–Oct. Queens County: Flushing, (L,R), 10, Aug. 5, 1945. New York City, common, May–Oct. Richmond County: Staten Island, (S,T), rare, June–Oct. Rockland County: Orangeburg, (S,T), rare, May–Aug. Suffolk County: Bellport, (4). Yaphank, (S,T), rare, July–Aug.

Anopheles occidentalis Dyar and Knab: This anopheline has been taken in small numbers from scattered localities in northern and western New York and has been found rather abundantly in Schuyler County at Cayuta Lake. Larvae have been taken in cool waters in association with those of *A. punctipennis*. Clinton County: Plattsburg, (L,R,S), common, June–Sept. Cattaraugus County: Randolph, (S), 2 females, Sept. 14, 1945, L. E. Perry. Essex County: Lake Placid, (L,R), 1, Aug. 22, 1945. Raybrook, Aug., (12). Franklin County: Buttermilk Falls on Raquette River, (12). Herkimer County: Old Forge, Aug., (5). Oneida County: Boonville, (S), 2 males, Aug. 24, 1944. Utica, (S,T), 1 female, Aug. 2, 1944; 1 female, Sept. 5, 1944. Oswego County: Oswego, (S), 1 male, Aug. 2, 1944. Schuyler County: Cayuta Lake, (B,L,S), abundant, Apr.–Sept. Warren County: Loon Lake, (L,R), 2, Aug. 21, 1945.

Anopheles punctipennis Say: Occurs throughout the State of New York as well as most of the United States. It breeds in almost all types of aquatic situations and is found from April through October. The adults have been found in shelters throughout the winter. It is recorded from 60 localities from the following counties: Albany, Cayuga, Clinton, Cortland, Dutchess, Erie, Essex, Genesee, Herkimer, Jefferson, Kings, Lewis, Livingston, Nassau, Niagara, Oneida, Onondaga, Ontario, Orange, Oswego, Queens, Rensselaer, Richmond, Rockland, Schoharie, Schuyler, Seneca, Steuben, Suffolk, Tompkins, Warren, Wayne, Westchester.

Anopheles quadrimaculatus Say: This species is the malaria mosquito of eastern United States. It breeds principally in permanent ponds and marshes where the water is warm and well supplied with aquatic vegetation or floating debris. It has been taken in all sections of the state except in the mountains and has been found in considerable numbers as far north as Plattsburg and Port Byron. At Port Byron, for example, an estimated 1000 adults were observed in an ordinary cow barn on July 6, 1944. Albany County: Albany, Aug.–Sept., (8). Cayuga County: North Fairhaven, July, (8). Port Byron, (L,S), abundant, July. Clinton County: Plattsburg, (B,L,R,S), abundant, June–Oct. Cortland County: Homer, (L,R), rare, Aug. Dutchess County: Hyde Park, (L), rare, July–Aug. Pawling, (B,L,S), abundant, May–Oct. Genesee County: Batavia, (S), common, July–Oct. Hamilton County: Wells, July, (8). Herkimer County: Old Forge, Aug., (8). Livingston County: Mount Morris, (8). Monroe County: Rochester, Sept., (8). Nassau County: Farmingdale, (6). Hempstead, (S,T), rare, June–Sept. Oyster Bay, (L,R,S), rare, Aug. Niagara County: Fort Niagara, (S), common, Aug.–Sept. Niagara Falls, (B,S), rare, July–Aug. Wilson, Aug., (8). Oneida County: Boonville, (L), rare, Aug. Utica, (L,S,T), rare, July–Oct. Onondaga County: Jordan, July, (8). Syracuse, (S), rare, Aug. Ontario County: Clifton Springs, Aug., (8). Geneva, (L,S), common, Aug. Orange County: Tuxedo, (13). West Point, (B,L,S,T), abundant, Jan.–Dec. Oswego County: Oswego, (S), rare, Aug. Queens County: Bayside, (4). Flushing, (T), rare, Aug. New York City, rare, July–Sept. Richmond County: Staten Island, Sept., (8). Rockland County: Orangeburg, (B,L,S,T), common, June–Oct. Schuyler County: Cayuta Lake, (B,L,R,S), abundant, May–Nov., (8, in part). Seneca County: Romulus, (S,T), rare, Aug.–Sept. Suffolk County: Bellport, Aug., (4). Brentwood, (S), rare, July. East Hampton, (13). Yaphank, (S,T), rare, Aug. Tompkins County: Ithaca, common, Jan.–Dec., (8, in part). McLean, Aug., (8). The Bronx: Bronx, (13). Wayne County: Sodus Point, June, (8). Westchester County: Mount Vernon, (13). South Salem, June, (8).

Anopheles walkeri Theobald: This species is probably more widespread and abundant than records indicate as both larvae and resting adults are more difficullt to locate than are most anophelines. The adults are readily obtained in biting col-

lections and by means of light traps. Cayuga County: North Fairhaven, June–Sept., (8). Clinton County: Plattsburg, (B,L,R), rare, Aug. Dutchess County: Pawling, (L,T), rare, July–Aug. Essex County: Saranac Lake, (B), common, Aug. Franklin County: Barnum Pond, Aug., (8). Duck Lake, July, (8). Monroe County: Rochester, Aug., (8). Niagara County: Fort Niagara, (T), rare, Sept. Niagara Falls, (B,S), common, June–Sept. Oneida County: Utica, (L,S,T), rare, June–Sept. Ontario County: Fishers, Sept., (8). Orange County: West Point, (B,L,T), common, Apr.–Oct. Rockland County: Orangeburg, (S,T), rare, June–Sept. Schuyler County: Cayuta Lake, (B,L), common, June–Aug., (8, in part). Waneta Lake, July, (8). Seneca County: Romulus, (L,T), rare, June–Aug. Tompkins County: Dryden Lake, July, (8). Ithaca, June–Sept., (8). Warren County: Bolton Landing, Aug., (8). Wayne County: Sodus Point, Aug.–Sept., (8).

Culex apicalis Adams: One of the most widespread and abundant *Culex* in the state. Larvae of this species are found abundantly in swamps and grassy pools. The adults feed on cold blooded vertebrates and are not known to bite man. It has been taken from 57 localities during the months from March to November. It has been taken from the following counties: Albany, Cattaraugus, Cayuga, Clinton, Cortland, Dutchess, Essex, Franklin, Herkimer, Jefferson, Kings, Lewis, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Oswego, Queens, Rensselaer, Richmond, Rockland, Schoharie, Schuyler, Seneca, Steuben, Suffolk, Tompkins, Warren, Wayne, and Westchester.

Culex pipiens Linnaeus: This is the northern house mosquito which breeds in rain barrels and other artificial receptacles as well as in waters polluted with sewage. It often occurs in very great numbers in urban communities and is one of the most important pest mosquitoes in the state. Albany County: Albany, March–Sept., (8). Karner, Oct. (5). Voorheesville, Aug., (8). Clinton County: Plattsburg, (B,L,S), rare, Sept.–Oct. Dutchess County: Hyde Park, (B,L,T), rare, June–Sept. Pawling, (L,S), common, July–Oct. Erie County: Erie County, July–Oct., (4). Essex County: Lake Placid, (L), common, July. Genesee County: Batavia, (S), rare, Oct. Kings County: Brooklyn, (B,S,T), rare, June–Oct. Sheepshead Bay, June–Sept., (8). Nassau County: Baldwin, May, (8). Hempstead, (L,R,S,T), common, June–Oct. Kings Point, (S), rare, Aug. Sands Point, (L,R), rare, Aug. New York County: Governors Island, (B,L,S,T), common, May. Niagara County: Fort Niagara, (L,R,S,T), common, May–Oct. Niagara Falls, (B,L,S), common June–Sept. Oneida County: Utica, (L,R,S,T), abundant, June–Oct. Onondaga County: Syracuse, (S), common, June–Aug. Ontario County: Geneva, (S), rare, Aug. Orange County: West Point, (B,L,S,T), abundant, Jan.–Dec. Queens County: Flushing, (B,L,R,S,T), common, June–Oct. New York City, abundant, Apr.–Oct. Queens Village, (L,R), common, July. Rensselaer County: Clinton Heights, Sept., (8). Nassau, Aug., (8). Richmond County: Staten Island, (L,R,S), common, May–Oct. Rockland County: Orangeburg, (L,S,T), abundant, May–Oct. Saratoga County: Schuyler, Aug., (8). Schuyler County: Cayuta Lake, Nov., (8). Seneca County: Romulus, (L,S,T), rare, Aug.–Sept. Suffolk County: Bellport, (4). Brentwood, (B,L,S). abundant, July–Oct. Yaphank, (B,L,S,T), common, May–Oct. Tompkins County: Ithaca, (L,S,T), common, (8, in part). The Bronx: Bronx, (B,L,S), abundant, Nov. Ulster County: Kingston, Sept., (8). Wayne County: Sodus Point, Sept., (8). Westchester County: New Rochelle, (L,S), rare, July–Aug.

Culex restuans Theobald: Very similar in appearance and habits to *C. pipiens*. It can usually be separated from it by the presence of small white dots on the mesonotum. This species appears to be very common throughout much of the state, Albany County: Albany, May, (8).

Karner, May–July, (8). Cayuga County: North Fairhaven, (L), July, (8). Chautauqua County: Westfield, June–Aug., (8). Clinton County: Plattsburg, (B,L,S), common, June–Sept. Dutchess County: Green Haven, (L), common June. Pawling, (L,S,T), common, July–Sept. Poughkeepsie, June, (8). Essex County: Elizabethtown, June–July, (8). Lake Placid, (L), rare, July–Aug. Franklin County: Saranac Inn, July, (8). Tupper Lake, Aug., (4). Greene County: Onteora Club, (5). Herkimer County: Mohawk, July, (8). Newport, Aug., (8). Old Forge, Aug., (8). Kings County: Brooklyn, (T), rare, May–July. Sheepshead Bay, June–Aug., (8). Nassau County: Hempstead, (L,R,S,T), common, June–Oct. Lawrence, (6). Merrick, (6). Woodmere, (6). New York County: Governors Island, (L,S,T), common, June–Sept. Niagara County: Fort Niagara, (S,T), rare, May–Aug. Niagara Falls, (B,L,S), rare, June–Aug. Oneida County: Forestport, June, (8). Utica, (L,R,S,T), abundant, June–Sept. Onondaga County: Syracuse, July, (8). Ontario County: Geneva, (S), rare, June. Orange County: West Point, (B,L,S,T), common, May–Oct. Queens County: Flushing, (B,L), rare, July–Sept. New York City, common, May–Sept. Queens Village, (L,R), rare, July. Rensselaer County: Clinton Heights, July–Sept., (8). Nassau, Sept., (8). Richmond County: Staten Island, (L,S,T), abundant, Apr.–Oct. Rockland County: Orangeburg, (L,S,T), abundant, May–Sept. Seneca County: Romulus, (L,T), common, June–Oct. Suffolk County: Bellport, (4). Brentwood, (S), abundant, July. Yaphank, (L,S,T), common, May–Oct. Ulster County: Binnewater, May–Aug., (8). Wayne County: Sodus, Aug., (5). Sodus Point, July–Sept., (8). Westchester County: New Rochelle, (L,S), rare, July.

Culex salinarius Coquillett: This species breeds in both fresh and brackish water and is common throughout most of the State. It has been found to be very abundant in the southeastern area, especially on Long Island. Albany County: Karner, May, (8). Chautauqua County: Westfield, Aug.–Sept. Clinton County: Plattsburg, (B,S), rare, Aug.–Sept. Dutchess County: Hyde Park, (L,T), rare, June–Sept. Pawling, (L,S), common, July–Sept. Genesee County: Batavia, (S), common, Oct. Kings County: Brooklyn, (S,T), rare, May–Sept. Sheepshead Bay, Aug.–Sept., (8). Nassau County: Hempstead, (S,T), common, June–Oct. Jones Beach, (6). Oyster Bay, July, (8). New York County: Governors Island, (B,S,T), common, June–Oct. Niagara County: Fort Niagara, (S,T), rare, June–Oct. Niagara Falls, (B,S), rare, July–Sept. Oneida County: Utica, (B,L,R,S,T), abundant, June–Oct. Onondaga County: Syracuse, June – July, (8). Orange County: West Point, (B,L,T), common, May – Nov. Queens County: Flushing, (B,L,R,S,T), abundant, May–Sept. Jamaica, (L,R), abundant, Sept.–Oct. New York City, abundant, June–Sept. Rensselaer County: East Schodack, May, (8). Nassau, Sept., (8). Schodack, May, (5). Richmond County: Staten Island, (B,S,T), common, May–Oct. Rockland County: Orangeburg, (L,S,T), abundant, May–Oct. Seneca County: Romulus, (T), rare, June–Sept. Suffolk County: Brentwood, (B,S), rare, Aug.–Oct. Yaphank, (B,L,S,T), common, June–Oct. Tompkins County: Dryden Lake, (8). Ithaca, (L,T), rare, July–Sept., (8, in part). Wayne County: East Sodus. May, (8). Westchester County: New Rochelle, (L,R), rare, July–Aug.

Culiseta impatiens (Walker): Extremely rare in New York. We have a single larva taken from a quarry pool near Plattsburg and two females collected with a light trap near Utica. Other records are available from the Cornell University collection. Cayuga County: North Fairhaven, (L), July, (8). Clinton County: Plattsburg, (L), 1 larva collected from a quarry pool on June 22, 1945 by Lt. J. J. Wurdack. Essex County: Cliff Mountain (Essex Co.), (5). Elizabethtown, Apr.–Aug., (4). Mt. Marcy, July, (8). Franklin

County: Saranac Inn, July, (8). Tupper Lake, (4). Oneida County: Utica, (T), 1 female, Sept. 13, 1944; 1 female, Sept. 15, 1944. Tompkins County: Ithaca, (L), (8).

Culiseta inornata (Williston): This large species has been taken sparingly from several scattered localities in New York. It is much less common here than in southern United States. Albany County: Albany, (4). Cayuga County: North Fairhaven, July, (8). Franklin County: Saranac Inn, Aug., (8). Herkimer County: Old Forge, June, (8). Niagara County: Fort Niagara, (S), 3 females, May 21–23, 1945; 1 female, June 6, 1945; 1 male and 1 female, Sept. 7, 1945. Niagara Falls, (L), 3, July 21, 1944. Oneida County: Utica, (L), 4, Sept. 28, 1945. Orange County: West Point, (T), 1 female, Aug. 24, 1945. Queens County: Flushing, (T), 1 female, June 26, 1945. New York City, rare, June. Richmond County: Staten Island, (T), 1 female, June 30, 1944; 3 females, May 28–June 6, 1945; 1 female, July 26, 1945. Rockland County: Orangeburg, (T), 2 females, July 6–7, 1944; 1 female, Aug. 26, 1944; 1 female, June 15, 1945; 1 female, Aug. 17, 1945. Suffolk County: Yaphank, (T), 1 female, Sept. 6, 1944; 1 male, Oct. 2, 1945; (B), 1 female, Sept. 19, 1945. Tompkins County: Ithaca, July–Nov., (8). Wayne County: Sodus Point, Aug., (8).

Culiseta melanura (Coquillett): This small mosquito closely resembles species of the genus *Culex*. It appears to be rather widely distributed in New York though the majority of our records are from the southeastern section. It has not been found in large numbers. Dutchess County: Pawling, (S), 1 female, Sept. 13, 1945. Franklin County: Duck Lake, Aug., (8). Tupper Lake, Aug., (4). Jefferson County: Watertown, (S), 3 females, 3 males, Sept. 8, 1943. Kings County: Brooklyn, (T), 1 female, June 9, 1945. Nassau County: Hempstead, (T), 1 male, Sept. 19, 1944; 1 male, Aug. 30, 1945; 1 male, Sept. 24, 1945. Merrick, (L), 2, May 6, 1937, (6). North Merrick, (L), 2, Apr. 28, 1937, (6). New York County: Governors Island, (S), 1 male, Sept. 13, 1945. Oneida County: Utica, (T), 1 female, Aug. 12, 1944; 3 females, Aug. 31–Sept. 1, 1944; 1 female, Sept. 7, 1944. Orange County: West Point, (S,T), rare, Aug.–Sept. Queens County: New York City, rare. Rockland County: Orangeburg, (T), 3 females, Aug. 31–Sept. 3, 1944; 5 females, Aug. 12–16, 1945. Schuyler County: Cayuta Lake, July, (8). Suffolk County: Yaphank, (T), 1 male, Sept. 20, 1945. Tompkins County: Ithaca, Sept., (8).

Culiseta morsitans (Theobald): Widely distributed throughout New York. It is apparently the most common species of *Culiseta* in the State. Cortland County: Homer, (S), 1 female, June 23, 1945. Dutchess County: Hyde Park, (T), rare, Sept. Pawling, (S,T), rare, May–Sept. Essex County: Elizabethtown, May–June, (8). Franklin County: Tupper Lake, Aug., "larva in cold swamp," (4). Herkimer County: Big Moose, June, (8). Niagara County: Fort Niagara, (T), 2 females, Aug. 31, 1945. Niagara Falls, (S), rare, July–Aug. Oneida County: Boonville, (S), rare, Aug. Utica, (S,T), rare, July–Sept. Onondaga County: Syracuse, (S), rare, Aug. Orange County: West Point, (L,S,T), rare, May–Sept. Queens County: Flushing, (T), rare, Aug. Rensselaer County: Nassau, May–June, (8). Rockland County: Orangeburg, (S,T), common, June–Sept. Schuyler County: Cayuta Lake, July–Sept., (8). Suffolk County: Yaphank, (S,T), rare, Aug.–Sept. Tompkins County: Ithaca, May, (8). McLean, June–July, (8). Ringwood, May–June, (8).

Mansonia perturbans (Walker): This large mosquito is a fierce biter and a severe pest in many localities in New York. We have found it in large numbers from such widely separated points as Staten Island, West Point, Niagara Falls, and Saranac Lake. Breeding takes place in marshes and ponds with a thick growth of vegetation. The larvae and pupae cannot be collected by ordinary means since

they remain below the water surface with their air tubes attached to stems and roots of plants. Cayuga County: North Fairhaven, July–Aug., (8). Spring Lake, June, (6). Clinton County: Plattsburg, (B), rare, July. Dutchess County: Pawling, (T), rare, June. Essex County: Lake Placid, (S), rare, July. Saranac Lake, (B), common, Aug. Genesee County: Le Roy, June, (8). Herkimer County: Old Forge, July, (8). Kings County: Brooklyn, (T), rare, July. Sheepshead Bay, July, (8). Monroe County: Rochester, June–July, (8). Nassau County: Hempstead, (T), rare, June–Aug. New York County: Governors Island, (T), rare, July. Niagara County: Fort Niagara, (T), rare, July–Aug. Niagara Falls, (B,L), common, June–Sept. Oneida County: Utica, (T), rare, June–Sept. Orange County: West Point, (B,T), common, June–Aug. Queens County: Flushing, (B,L), common, June–July. New York City, common, June–Sept. Richmond County: Staten Island, (B,S,T), common, June–Sept. Rockland County: Orangeburg, (S,T), rare, June–Sept. Schuyler County: Waneta Lake, June–July, (8). Watkins Glen, June–July, (8). Seneca County: Romulus, (T), rare, July–Aug. Suffolk County: Calverton, June, (6). Yaphank, (B,T), rare, July. Tompkins County: Dryden Lake, June, (8). Ithaca, June–Aug., (8). Wayne County: Sodus, July, (5). Sodus Point, June–July, (8).

Orthopodomyia alba Baker: Described from Ithaca, New York and has not since been collected in the State. It breeds in tree holes as does the closely related *O. signifera.* Adults of these two species are very difficult to separate with certainty. Tompkins County: Ithaca, (L,R), Aug.–Nov., (8).

Orthopodomyia signifera (Coquillett): This tree-hole-breeding species is rare in New York. It has been taken in small numbers from six localities. Nassau County: Baldwin, (L), 1, Aug. 29, 1945, H. Schiff. Hempstead, (T), 1 female, Sept. 4, 1945; 1 female, Sept. 8, 1945. New York County: Governors Island, (S), 1 female, Aug. 20, 1945. Queens County: New York City, rare, Aug.–Sept. Rockland County: Orangeburg, (T), 1 female, July 20, 1945; 1 female, Aug. 22, 1945; 1 female, Sept. 25, 1945. Tompkins County: Ithaca, Aug.–Nov., (8).

Psorophora ciliata (Fabricius): This is the largest species of mosquito known from New York and is also one of the most vicious biters. It has been taken at several widely scattered points but has not been found in important numbers. Albany County: Albany, Aug., (8). Karner, June–July, (8). Clinton County: Plattsburg, (L), 4, July 19, 1945; (B), 3 females, July 27, 1945. Valcour Island, (8). Dutchess County: Arlington, July, (8). Pawling, (T), 1 male and 1 female, July 30–Aug. 4, 1945. Erie County: North Evans, Aug., (5). Franklin County: Duck Lake, Aug., (8), Herkimer County: Little Falls, Aug., (8). Kings County: Sheepshead Bay, May–July, (8). Niagara County: Fort Niagara, (T), 9 females, July 30–Aug. 9, 1945. Niagara Falls, Aug., (8). Oneida County: Utica, (T), 1 male, July 6, 1944. Ontario County: Clifton Springs, Aug., (8). Orange County: Warwick, July, (8). Queens County: New York City, rare, Aug. Richmond County: Staten Island, (T), 1 female, Aug. 7, 1945; Sept., (8). Rockland County: Orangeburg, (T), 1 male and 1 female, Aug. 3–4, 1945. Seneca County: Romulus, (T), 2 females, July 28–29, 1945. Suffolk County: East Quogue, (6). Tompkins County: Ithaca, (8). Wayne County: Lyons, July, (4). Sodus Point, July–Sept., (8). Westchester County: Larchmont, (4).

Psorophora confinnis (Lynch-Arribalzaga): A very important pest in southern United States, but is rare in New York. Except for a single specimen taken from Utica all records are from the southeastern part of the state. Nassau County: Hempstead, (T), 1 female, Aug. 13, 1945; 1 female, Aug. 25, 1945. New York County: Governors Island, (T), 2 females, Aug. 13–14, 1945. Oneida County: Utica, (T), 1 female, Aug. 30, 1945. Queens County:

Flushing, (B), 1 female, Aug. 22, 1944. New York City, rare, June–Oct. Richmond County: Staten Island, (L,T), 6 adults and 2 larvae, Aug.–Oct. (U. S. Army collections identified by New Jersey Agricultural Experiment Station). Rockland County: Orangeburg, (T), 5 females, Aug. 22–23, 1945; 1 female, Aug. 29, 1945. Suffolk County: Cold Spring Harbor, (4).

Psorophora ferox (Humbolt): This species is known as the white-footed woods mosquito. It is a severe biter in wooded areas but is very rare in New York. Dutchess County: Hyde Park, (B), 1 female, Aug. 2, 1944. Poughkeepsie, Aug., (8). Kings County: Sheepshead Bay, July, (8). Orange County: West Point, (B), 1 female, Aug. 29, 1945. Richmond County: Staten Island, (B), 3 females, Aug. 11, 1945. Tompkins County: Ithaca, Apr., (8).

* *Psorophora varipes* (Coquillett): This southern species has not been previously reported north of Maryland. This record is based upon a single female which was taken in a biting collection at Willowbrook Park, Staten Island (Richmond County), New York on Aug. 11, 1945 by H. M. Schiff. This specimen has been deposited in the Cornell University collection.

Uranotaenia sapphirina (Osten Sacken): This small brilliantly colored mosquito is fairly common in New York. It is not a pest species as it seldom bites man. Albany County: Albany, Aug., (8). Cayuga County: Port Byron, (L), rare, July. Clinton County: Plattsburg, (L), rare, Aug.–Sept. Cortland County: Homer, (L), rare, Aug. Dutchess County: Hyde Park, (L,T), July–Sept. Pawling, (L), common, Aug.–Sept. Kings County: Brooklyn, (4). Nassau County: Farmingdale, Aug., (6). Hempstead, (T), rare, Aug.–Oct. Oyster Bay, (L,T), common, Aug. New York County: Governors Island, (L,T), rare, Aug.–Sept. Niagara County: Niagara Falls, (S,T), rare, Aug.–Sept. Oneida County: Utica, (T), common, July–Oct. Orange County: Pine Island, (L), Aug., (8). West Point, (L,T), common, May–Oct. Queens County: Flushing, (T), rare, Aug.–Sept. New York City, common, June–Oct. Rensselaer County: Greenbush, Aug., (5). Richmond County: Staten Island, (L,T), rare, June–Aug. Rockland County: Orangeburg, (L,T), rare, May–Sept. Seneca County: Romulus, (T), rare, Sept. Suffolk County: Bellport, Sept., (4). Yaphank, (T), rare, Aug.–Oct. Tompkins County: Ithaca, Aug.–Oct., (8). Wayne County: Sodus Point, Aug., (8).

Wyeomyia smithii (Coquillett): This is a very small dark species which breeds in the water contained in pitcher plants. The females are not known to bite man. The writers have reared a series of specimens from larvae collected from a bog near Plattsburg (Clinton County) on Aug. 24, 1945. Clinton County: Plattsburg, (L,R), common, July–Aug. Franklin County: Duck Lake, July, (8). Saranac Inn, July–Aug., (8). Tupper Lake, Aug., (4). Herkimer County: Big Moose, June, (8). Old Forge, June–July, (8). Lawrence County: East Crooked Pond, July, (8). Tompkins County: Ithaca, June–Aug., (8). McLean, June–Aug., (8).

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NEW DISTRIBUTION RECORDS FOR THE MOSQUITOES OF NEW ENGLAND [1]

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The Public Health Service conducted many anopheline mosquito surveys in New England during the period 1942–45. These surveys were made in the vicinities of Army, Navy, and Veterans Administration establishments principally in Massachusetts, Rhode Island, and Connecticut. Relatively few collections were made in the northern New England states of Maine, New Hampshire, and Vermont. Principal emphasis was placed on anopheline mosquitoes during this work though other species encountered were also collected and identified. Collections made during these surveys as well as other miscellaneous collections made by the writers are summarized in this report. A few records from the Cornell University Collection and from the collections of Dr. Harry D. Pratt are also included.

Thirty-four species of mosquitoes were taken during the period reported. These species are given in alphabetical order in the following list. Included also for each species are the localities where collected, types of collections, abundance, and the earliest and latest months of collection. Nine species known from New England, which were not taken by the writers, are also included in the list. These records are from Howard, Dyar and Knab (1917), Johnson (1925), Dyar (1928), Lowry (1929), Lathrop (1939), Tulloch (1939), Getting and Feemster (1940), King and Bradley (1941), Knutson (1943), Matheson (1945), and Scott (1948, 1949).

Symbols are used to designate the type of collections for each of the locality records given below as follows: (B)—biting; (L)—larval; (R)—reared from larvae or pupae; (S)—diurnal resting station; and (T)—light traps. Each species is rated as "rare," "common," or "abundant" for each locality. In general, a species is considered to be rare if no more than nine specimens were taken in any one collection, common if from 10 to 99 specimens were taken, and abundant if 100 or more were taken in a single collection. For some of the rarer species the exact numbers of specimens collected are stated as are the specific dates of collection.

Aedes atropalpus (Coquillett): Locally distributed throughout eastern United States (Matheson, 1944). It breeds in rock holes along streams and lakes and is

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known from all of the New England states. **Maine:** Orono (Cornell University Collection); **Rhode Island:** Jamestown (L), common, August, H. I. Scudder; Point Judith (L), abundant, August, H. I. Scudder; **Vermont:** Pittsford, August (Cornell University Collection).

Aedes aurifer (Coquillett): A common spring species in southern New England which often proves to be a troublesome pest in wooded areas. Scott (1949) also reports it as being quite numerous in Vermont. **Connecticut:** Avon 1 female, July 11, 1945; Old Mystic (L,R,S), rare, April–May; Round Hill (L,R), rare, May. **Massachusetts:** Ayer (T), rare, July; Framingham (T), rare, May–July (Two males determined by genitalia); Needham (L), rare, April; Taunton (B,S,T), common, May–June; Waltham (L,S,T), rare, April–June; West Roxbury (B), common July. **Rhode Island:** East Greenwich (B), common, July; Hope Valley (B), common, June; Wickford (B,L,R,S,T), common, April–July.

Aedes canadensis (Theobald): This common mosquito occurs throughout New England. It is usually the first species to occur in the spring and often proves to be a serious pest. It has been found from March through September. **Connecticut:** Avon (T), rare, June; Guilford (L,R), common, April–May; Norwalk (L,R), common, May–June; Old Mystic (L,R), common, April; Round Hill (L,R), abundant, May; Stafford (L,R), common, May. **Maine:** Portland (B), common, August, H. I. Scudder; Presque Isle (B), rare, August. **Massachusetts:** Ayer (B,L,S,T), common, May–August; Framingham (B,L,R,S,T), common, March–June; Northampton (B), rare, August; Taunton (S), rare, May; Waltham (L,R,S,T), rare, April–September. **Rhode Island:** Escoheag (B), rare, June; South Foster (L,R), abundant, April; Wickford (B,L,S,T), common, April–July. **Vermont:** Jacksonville (L), 3, August 20, 1943, H. D. Pratt.

Aedes cantator (Coquillett): Breeds in the brackish marshes along the Atlantic Coast from Connecticut to Maine. It is an annoying pest in some localities. Not reported from **Vermont. Connecticut:** Avon (T), rare, June; **Maine:** Brunswick (B), rare, August; Kittery (B,L), common, August; Portland (B,L), abundant, August, H. I. Scudder. **Massachusetts:** Ayer (S,T), rare, June–August; Boston (S,T), rare, June–July; Framingham (S,T), rare, May–August; Taunton (S), rare, June–July; Waltham (S), rare, July. **New Hampshire:** Portsmouth (B,L), abundant, August, H. I. Scudder. **Rhode Island:** East Greenwich (B), rare, July; Wickford (B,L,R,S,T), common, April–October.

Aedes cinereus (Meigen): This small brown mosquito is widespread in New England. It is a fierce biter and an important pest in many areas. It occurs in all of the New England states but has been found in greatest numbers in **Massachusetts. Connecticut:** Columbia (L,R), rare, April; Round Hill (L,R), rare, May; Stafford (L,R), rare, May. **Maine:** Portland (B), common, August; Presque Isle (B), 2 females, August 6, 1942, H. I. Scudder. **Massachusetts:** Ayer (B,L,S,T), common, June–October; Boston (T), rare, June–July; Framingham (B,L,R,S,T), common, April–October; Hingham (B,S,), rare, June; Needham (L,S), rare, April–May; Taunton (B,S,T), common, May–October; Waltham (L,R,S,T), rare, April–October; Worcester (B), common, August. **New Hampshire:** Portsmouth (L), August 11, 1942, H. I. Scudder. **Rhode Island:** Wickford (B,T), rare, May–July. **Vermont:** Brandon (B), 2 females, August 30, 1945; Jacksonville (L,R), 3; August 15–20, 1943, H. D. Pratt; Lake Dunmore (B), 7 females, August 29, 1945; Wallingford (B), 1 female, August 31, 1945.

Aedes communis (De Geer): *A. communis* was not taken in New England by the writers although it has been reported from **Maine, Massachusetts,** and **New Hampshire** (Johnson, 1925). Lowry (1929) states that it is the most common black-legged woods mosquito in **New Hampshire.**

Aedes diantaeus (Howard, Dyar, and Knab): This species is quite rare in New England. It has not been encountered by the writers though it has been recorded in **Maine** and **New Hampshire** by Howard, Dyar, and Knab (1917) and Johnson (1925).

Aedes dorsalis (Meigen): Listed from **Connecticut** and **Massachusetts** (Howard, Dyar, and Knab, 1917). It was not taken by the writers.

Aedes excrucians (Walker): Occurs throughout most of New England, being recorded from every state. It is difficult to distinguish from *A. fitchii* and *A. stimulans* and records based on females only should be regarded as tentative. **Connecticut:** Avon (T), rare, June; Round Hill (L,R), rare, May. **Maine:** Portland (B), common, August, H. I. Scudder. **Massachusetts:** Ayer (S,T), rare, May–August; Boston (T), rare, June–July; Framingham (B,L,R,S,T), rare, April–August (3 males determined by genitalia); Hingham (B,S), rare, June–July; Needham (L,S), rare, April–May; Taunton (B,S,T), common, May–August; Waltham (L,R,S,T), rare, April–June; West Roxbury (S), rare, July. **New Hampshire:** Suncook (S), rare, September. **Rhode Island:** Wickford (B,L,S,T), rare, May–July.

Aedes fitchii (Felt and Young): Similar in appearance and habits to *A. excrucians* and *A. stimulans*. It is known from all of the New England states. **Connecticut:** Avon (B,S,T), rare, May–July; Old Mystic (L,R), rare, May 15, 1945 (2 males determined by genitalia); Round Hill (L,R), rare, May 17, 1945 (2 males determined by genitalia). **Maine:** Portland (B), rare, August. **Massachusetts:** Ayer (S,T), rare, June–August; Boston (T), rare, June–July; Framingham (B,L,R,S,T), rare, April–July (2 males determined by genitalia); Hingham (B,S), rare, June–July; Needham (L), rare, April; Taunton (S), rare, May; Waltham (L,T), rare, April–June. **Rhode Island:** Wickford (B,L,R,S,T), common, May–June (4 males determined by genitalia).

Aedes grossbecki (Dyar and Knab): A rare species in northeastern United States which has not been reported previously from New England. The writers have identified a single female which was reared from a larva collected on August 20, 1943, by H. D. Pratt from the marginal waters of Laurel Lake, near Jacksonville, **Vermont**.

Aedes impiger (Walker): This rare northern species was not taken by the writers. It is apparently recorded only for **New Hampshire.** (Johnson, 1925.)

Aedes implacabilis (Walker): An early spring species which is reported from all of the New England states except **Maine.** The females cannot be separated from those of *A. punctor* and positive determinations must be based on larvae or male genitalia. **Connecticut:** Columbia (L, R), 3 males reared from collection of April 12, 1945 (determined by genitalia); Guilford (S), 1 male, May 15, 1945 (determined by genitalia). **Massachusetts:** Framingham (T), 14 males, May–June (determined by genitalia); Taunton (T), 9 males, May–June (determined by genitalia). **Rhode Island:** South Foster (L,R), 7 males and 15 females reared from larvae collected April 12, 1945. Males verified by genitalia.

Aedes implacabilis (Walker) or *A. punctor* (Kirby): The following records refer to female specimens which belong to one of these two closely related species but could not be positively identified. **Connecticut:** Avon (S,T), 2 females, May 22, 1945, 1 female, July 6, 1945; Old Mystic (S), 1 female, May 15, 1945; Round Hill (B), 3 females, May 17, 1945; Stamford (B), 1 female, May 15, 1945. **Massachusetts:** Ayer (S), rare, May–June; Cochituate (L,R), 1 female, April 19, 1945; Framingham (B,S,T), rare, May–June; Hingham (B), common, June; Needham (S), common, May; Taunton (B,S,T), common, May–June; Waltham (S,T), 4 females, May 15–31, 1945. **Rhode Island:** Escoheag (B), common, June; Hope Valley (B), 1 female, June 30, 1944; Wickford (B,S,T), common, May.

Aedes intrudens (Dyar): Is known from all of the New England states except **Vermont** though the writers found it

journal-of-the-american-mosquito-control-

only in **Massachusetts.** Knutson (1943) reports it as a common pest in **Rhode Island** during late May and June. **Massachusetts:** Framingham (S,T), 2 females, June 1–18, 1944; Hingham (B), 1 female, June 14, 1944; Needham 1 female, May 16, 1945; Taunton (S), 1 female, May 8, 1945, 2 females, June 2, 1944; Waltham (L,R), 1 male, April 25, 1945 (determined by genitalia).

Aedes punctor (Kirby): This species appears to be much less common than *A. implacabilis* which it resembles closely. We have a single definite record for the entire New England area, although it has been reported from **Maine** and **New Hampshire. Massachusetts:** Ayer (T), 1 male (determined by genitalia), July 25, 1944.

Aedes sollicitans (Walker): An important pest mosquito along the Atlantic Coast where it breeds in saline pools. It has been observed in great numbers from **Maine** to **Rhode Island.** It is also widely distributed along the coastal regions of **Connecticut** (Matheson, 1945). Not recorded for **Vermont. Maine:** Brunswick (B), common, August; Kittery (B, L), abundant, September; Portland (B, L), common, August, H. I. Scudder. **Massachusetts:** Ayer (T), rare, July; Boston (T), rare, June–July; Framingham (T), rare, July–September; Taunton (T), rare, August. **New Hampshire:** Portsmouth (B,L), abundant, August, H. I. Scudder. **Rhode Island:** Sakonnet Point (L), abundant, August, H. I. Scudder; Wickford (L), abundant, June–September.

Aedes sticticus (Meigen): Found in significant numbers only in **Vermont.** It is considered by Scott (1948) to be one of the five most important pest species in this state. **Connecticut:** Avon (T), rare, May–June. **Maine:** Portland, 1 female, August 3, 1942, H. I. Scudder; **Massachusetts:** Ayer (T), 3 females, July 17–August 4, 1944. **Vermont:** Brandon (B,S), 17 females, August 25–30, 1945; Lake Dunmore (B,S), common, August; Wallingford (B), 4 females, August 31, 1945.

Aedes stimulans (Walker): This mosquito is a fierce biter but was infrequently encountered. It is very difficult to distinguish from *A. excrucians* and *A. fitchii* except by the male genitalia or larva. It has been recorded from all New England states. **Connecticut:** Avon (S,T), rare, June–July; Round Hill (L,R), rare, May. **Massachusetts:** Ayer (S,T), rare, May–August; Boston (T), rare, June–July; Framingham (B,L,R,S,T), rare, March–July; Hingham (S), rare, June; Taunton (S,T), rare, June–August; Waltham (S), rare, July. **Rhode Island:** Wickford (B,T), rare, May–June.

Aedes taeniorhynchus (Wiedemann): This small salt marsh mosquito has been reported from many localities in **Connecticut** (Matheson, 1945) and **Massachusetts** (Getting and Feemster, 1940). According to Johnson (1925) it also occurs in **Rhode Island.**

Aedes trichurus (Dyar): Appears to be a rare species in New England, although recorded from all six states. A small number of specimens were collected in **Connecticut, Massachusetts and Vermont. Connecticut:** Avon (T), 1 female, May 19, 1945, determined by Dr. Robert Matheson. **Massachusetts:** Framingham (B,L,S,T), 4 females, May 17, 30, 1944; May 15, June 10, 1945; 1 larva, March 20, 1945; Taunton (S), 2 females, June 2, 1944; Waltham (L,R), 1 larva, April 19, 1945. **Vermont:** Manchester, June (Cornell University Collection).

Aedes triseriatus (Say): This small tree-hole-breeding species while, recorded from all 6 states, was found rather infrequently though it may be locally abundant at times. **Maine:** Portland, August, H. I. Scudder. **Massachusetts:** Ayer (B,T), rare, June–August; Boston (T), rare, June–July; Chicopee (B), rare, August; Framingham (B,S,T), common, June–September; Waltham (B,S), rare. **Vermont:** Jacksonville (B), 1 female, August 20, 1943, H. D. Pratt; Wallingford (B), 1 female, August 31, 1945.

Aedes trivittatus (Coquillett): This species appears to be very rare in New England though it is known from all states except **New Hampshire** and **Vermont.**

Connecticut: Canaan (B), 3 females, August 30, 1945. **Maine:** Portland, 6 adults, August 3–5, 1942, H. I. Scudder.

Aedes vexans (Meigen): This is considered the most important pest mosquito in most inland areas of New England. It was found in great numbers in all states except **New Hampshire,** although Lowry (1929) reports it as "a common species" in this state. **Connecticut:** Avon (B,S,T), common, May–September; Canaan (B), rare, August; Guilford (L, R,S), abundant, May. **Maine:** Portland (B), abundant, August. **Massachusetts:** Ayer (L,S,T), abundant, May–October; Boston (T), abundant, June–July; Chicopee (B), abundant, July–August; Framingham (B,L,S,T), abundant, May–October; Hingham (B), common, June; Holliston (B), abundant, July; Northampton (L,S,T), abundant, August–September; Taunton (B,L,S,T), abundant, May–October; Waltham (B,L,S,T), abundant, June–October; West Roxbury (B,L, S), abundant, July–September. **Rhode Island:** Wickford (L,R,S,T), common, May–October. **Vermont:** Brandon (B,S), common, August; Lake Dunmore (B,S), common; Jacksonville (L,R), common, August 20, 1943, H. D. Pratt.

Anopheles crucians (Wiedemann): Occurs sparsely in the southern New England states. We have taken only twelve specimens from **Massachusetts** and **Rhode Island.** It is also known from **Connecticut** (Matheson, 1945). **Massachusetts:** Ayer (T), 1 female, September 2, 1944; Taunton (S,T), 4 females, July 2–August 30, 1945; Waltham (T), 1 female, August 15, 1944. **Rhode Island:** Wickford (T), 3 males, 3 females, August 27, 30, September 5, 11, 27, 1945.

Anopheles earlei (Vargas): This species has been previously referred to as *A. maculipennis* Meigen or *A. occidentalis* Dyar and Knab. It is widely distributed in New England but appears to be common only in the more northern areas, and has not been recorded from **Rhode Island. Maine:** Brunswick (L,S), common, August; Liberty (L), 1, August 17, 1944; Portland (L), 1, August 15, 1944. **Massachusetts:** Ayer (S), 1 female, September 7, 1944. **New Hampshire:** West Peterboro (S), 2 females, November 8, 1945. **Vermont:** Danby (S), 1 female, August 31, 1945.

Anopheles punctipennis (Say): This is the most abundant anopheline in New England, having been collected in almost all areas studied. **Connecticut:** Avon (L,R,S,T), common, May–September; Canaan (B), rare, August. **Maine:** Brunswick (L), rare, August; Liberty (L,R), common, August; Portland (L,S), rare, August; Presque Isle (S), rare, August, H. I. Scudder. **Massachusetts:** Ayer (L,S,T), common, April–December; Boston (T), rare, June–July; Chicopee (B,L,S), common, August–September; Framingham (L,R,S,T), common, March–December; Hingham (L), rare, June; Northampton (L,S), rare, August–September; Springfield (L,R,S), rare, August; Stockbridge (L), rare, August; Taunton (L,R,S,T), common, February–December; Waltham (L,S,T), abundant, January–December; West Roxbury (S), common, July–September. **New Hampshire:** Bennington (S), 1 female, August 30, 1945, L. E. Perry; East Jaffrey (S), 1 female, August 30, 1945, L. E. Perry; Hillsboro (S), 1 female, August 30, 1945, L. E. Perry; Suncook (L,S), rare, September; West Peterboro (S), common, August–November. **Rhode Island:** Newport (L), rare, June; Portsmouth (L), rare, August, H. I. Scudder; Wickford (L,S), rare, May–October. **Vermont:** Bellows Falls (L,R), rare, August; Brandon (L,R), common, August; Burlington (S), rare, August; Castleton (Cornell University); Danby (S), common, August; Dummerston (L,R), rare, August; East Dorset (L,R,S), common, August; Jacksonville (L,R), common, August 20, 1943, H. D. Pratt; Lake Dunmore (B), rare, August; Putney (L), rare, August; Westminster (L,R), rare, August.

Anopheles quadrimaculatus (Say): This important vector of malaria in eastern and southern United States is abundant in many areas of New England. It has been found in very large numbers in **Rhode**

journal-of-the-american-mosquito-control-

Island and **Massachusetts** and somewhat less commonly in **Connecticut, Maine, New Hampshire,** and **Vermont.** It has not been taken in mountainous areas nor in the northern regions of **Maine** and **New Hampshire.** It was found in several localities in the Lake Champlain Valley of **Vermont** as far north as Burlington (Barnes, 1946). **Connecticut:** Avon (L,S), common, July–September. **Maine:** Kittery (L,S), 1 female, 3 larvae, September 7, 1944. **Massachusetts:** Ayer (B,L,S,T), abundant, May–November; Boston (T), rare, June–July; Chicopee (B), rare, August; Framingham (B,L,S,T), abundant, May–November; Lowell, August (Cornell University); Northampton (L,S), common, August–September; Stockbridge (L,R), common, August; Taunton (B,L,S,T), abundant, May–November; Waltham (B, L,S,T), abundant, July–November; West Roxbury (L,S), rare, July–September. **New Hampshire:** Bennington (S), 1 female, August 30, 1945, L. E. Perry; Portsmouth (L), rare, August; Suncook (L), rare, September; Webster (S), 1 female, August 29, 1945. **Rhode Island:** Portsmouth (L), common, August, H. I. Scudder; Sakonnet Point (L), common, August, H. I. Scudder; Wakefield (S), rare, August, H. I. Scudder; Wickford (B, L,R,S,T), abundant, May–October. **Vermont:** Brandon (L), rare, August; Burlington (S), common, August; East Dorset (S), 3 males, 4 females, August 31, 1945; Hubbardton (L,R), common, August; Hyde Manor (L,R), common, August.

Anopheles walkeri (Theobald): Widely distributed in New England and is probably more abundant than present records indicate as it is seldom encountered in natural resting places where *A. quadrimaculatus* is so frequently found. Knutson (1943) has reported this species breeding abundantly in **Rhode Island** and Scott (1949) states that it was "readily found in all parts of **Vermont.**" **Maine:** Rangeley, August (Cornell University Collection). **Massachusetts:** Ayer (S,T), rare, June–October; Chicopee (B), rare, August; Framingham (B,L,S,T), rare, May–November; Taunton (S,T), rare, May–September; Waltham (L,S,T), rare, June–September. **New Hampshire:** Center Harbor (Cornell University Collection). **Vermont:** Hubbardton (L), August 26, 1945.

Culex pipiens (Linnaeus): The northern house mosquito is one of the most important pest species of this area. It is particularly abundant in urban areas. **Connecticut:** Avon (T), common, May–September; Round Hill (L,R), rare, May. **Maine:** Portland (L,S), abundant, August. **Massachusetts:** Ayer (L,R,S, T), common, May–October; Boston (T), common, July–August; Chicopee (B,L,S), common, August, H. I. Scudder; Framingham (L,S,T), abundant, April–December; Lowell, August–September (Cornell University Collection); Taunton (L,S,T), common, May–September; Waltham (L, S,T), common, May–October; West Roxbury (L,S), July–August. **New Hampshire:** West Peterboro (S), 3 females, November 8, 1945. **Rhode Island:** Wickford (L,S,T), abundant, May–October.

Culex restuans (Theobald): This species is very similar to *C. pipiens* and is found commonly in most areas of New England, being reported from all states. **Connecticut:** Avon (L,S,T), rare, June–September; Round Hill (L,R), rare, May. **Maine:** Portland (L,S), rare, August. **Massachusetts:** Ayer (L,S,T), rare, May–October; Boston (T), rare, June–July; Framingham (L,S,T), common, May–October; Hingham (S), common, June; Taunton (L,T), rare, June–October; Waltham (L,S,T), rare, July–October; West Roxbury (S), rare, July. **New Hampshire:** Portsmouth (L), common, August. **Rhode Island:** Wickford (L, T), rare, June–October. **Vermont:** Jacksonville (L,R), common, August 15–20, 1943, H. D. Pratt.

Culex salinarius (Coquillett): A common species breeding in both fresh and saline waters. It is now known from all six New England states. **Connecticut:** Avon (S), rare, August. **Maine:** Portland (L,S), abundant, August. **Massa-**

chusetts: Ayer (L,S,T), common, June–October; Boston (S,T), common, June–August; Chicopee (B), common, August; Framingham (L,S,T), rare, June–October; Taunton (L,S,T), common, June–November; Waltham (L,S,T), common, July–October; West Roxbury (S), rare, July. **New Hampshire:** Portsmouth (L), 2, August 11, 1942, H. I. Scudder. **Rhode Island:** Wickford (L,S,T), abundant, May–October. **Vermont:** Westminster (L,R), 5, August 29, 1945.

Culex territans (Walker): This small brown mosquito is abundant throughout the New England area. It is more commonly referred to in the literature as *C. apicalis* Adams. **Connecticut:** Avon (L, R,S), common, July–September. **Maine:** Kittery (L), common, September; Portland (L,S), common, August. **Massachusetts:** Ayer (L,R,S,T), abundant, May–October; Boston (T), rare, July; Chicopee (L,S), common, August; Framingham (L,R,S), common, May–October; Hingham (L), rare, June; Northampton (S), common, August–September; Springfield (L,R), common, August; Stockbridge (L), rare, August; Taunton (L,S, T), common, May–November; Waltham (L,S,T), common, May–October; West Roxbury (S), rare, July. **New Hampshire:** Portsmouth (L), common, August; Suncook (L,S), rare, September; West Peterboro (S), common, November. **Rhode Island:** Hope Valley (L), rare, June; Newport (L), rare, June; Wickford (L,R,S,T), abundant, May–September. **Vermont:** Hubbardton (L,R), 3 larvae, August 26, 1945; Hyde Manor (L,R), 6 larvae, August 26, 1945; Jacksonville (L,R), common, August 20, 1943, H. D. Pratt; Westminster (L,R), 3 larvae collected August 29, 1945.

Culiseta impatiens (Walker): This rare northern species was taken only in **Massachusetts.** It has also been reported from **Maine** and **New Hampshire** (Howard, Dyar, and Knab, 1917). **Massachusetts:** Waltham, 4 females, August 8, 1945.

Culiseta inornata (Williston): This species was not taken in New England by the writers but has been recorded from **Massachusetts** by Howard, Dyar, and Knab (1917). It was also taken in very small numbers in this state by Getting and Feemster (1940).

Culiseta melanura (Coquillett): This small species is fairly common in **Massachusetts** and somewhat less common in **Rhode Island** and **Maine.** According to Lowry (1929) it is rare and local in **New Hampshire. Maine:** Kittery (S), 1 male, September 7, 1944. **Massachusetts:** Ayer (S,T), rare, July–October; Boston (T), rare, June; Framingham (S, T), common, June–October; Springfield (S), rare, August; Taunton (S,T), common, May–September; Waltham (S,T), rare, June–October. **Rhode Island:** Wickford (L,S,T), rare, June–September.

Culiseta morsitans (Theobald): Has been found in small numbers in several localities in **Massachusetts, Connecticut** and **Rhode Island.** It was found to be common only in Ayer and Framingham, **Massachusetts. Connecticut:** Stafford (L,R), 3, May 11, 1945. **Massachusetts:** Ayer (S,T), common, June–August; Boston (T), rare, July; Chicopee (S), rare, August; Framingham (S,T), common, May–October; Needham (L), rare, May; Taunton (S,T), rare, May–September; Waltham (L,S,T), rare, April–October; West Roxbury (S), rare, July. **Rhode Island:** Wickford (L,T), rare, June–August.

Mansonia perturbans (Walker): This species is a severe biter and has been found to be an important pest in a few localities in **Massachusetts** and **Rhode Island.** Its abundance in northern New England is less well known, though Scott (1949) reports it as a pest in Burlington, Newport, and Windsor, **Vermont. Maine:** Portland, 1 adult, August 3, 1942, H. I. Scudder. **Massachusetts:** Ayer (S,T), common, June–September; Boston (T), rare, June–July; Framingham (B,S,T), abundant, June–September; Taunton (S,T), common, June–September; Waltham (S,T), rare, June–August. **New Hampshire:** West Peterboro (S), 1 female, November 8, 1945. **Rhode Island:** East Greenwich (B), common,

July; Wickford (B,S,T), common, June–August.

Orthopodomyia signifera (Coquillett): This tree-hole breeding mosquito was not taken by the writers but is known from **Connecticut** (Matheson, 1945), **Massachusetts** (Tulloch, 1939), and **Rhode Island** (Knutson, 1943).

Psorophora ciliata (Fabricius): This large mosquito is a fierce biter, but fortunately is quite rare in New England. It has also been recorded for **New Hampshire. Connecticut:** Avon (B,S), 1 female, July 11, 1945. **Massachusetts:** Chicopee (B), 1, August 7, 1942, H. I. Scudder. **Rhode Island:** Wickford (T), 1 female, August 21, 1945.

Psorophora confinnis (Lynch Arrabalzaga): This important southern species has been reported from **Massachusetts** (Tulloch, 1939). It is otherwise unknown in New England.

Psorophora ferox (Humboldt): The writers have taken a single specimen of this species in New England. It is also known from **Connecticut** (Matheson, 1945). **Massachusetts:** Framingham (B), 1 female, July 11, 1944.

Uranotaenia sapphirina (Osten Sacken): This small species is very abundant in many areas, and has been recorded from all states but **Maine.** Larvae have been encountered much more frequently than adults. **Massachusetts:** Ayer (L,T), abundant, July–August; Boston (T), rare, June–July; Framingham (L,T), common, July–October; Taunton (L,R,S,T), common, June–October; Waltham (L,T), common, July–September. **New Hampshire:** Portsmouth (L), common, August. **Rhode Island:** Wickford (L,R,T), abundant, June–September. **Vermont:** Hubbardton (L,R), 7, August 26, 1945; Hyde Manor (L,R), 4, August 26, 1945.

Wyeomyia smithii (Coquillett): No special search was made for this species which breeds in water found in the leaves of the pitcher plant. It has been previously reported from all states except **Vermont** and it undoubtedly occurs in that state as the writers have found it commonly at nearby Plattsburg, **New York.**

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IN MEMORIAM

WILLIAM BRODBECK HERMS

1876–1949

William Brodbeck Herms, Professor of Parasitology, Emeritus, passed away suddenly on May 9, 1949 as a result of a heart attack.

In reviewing his career of many facets, it is difficult to decide where the emphasis should be placed, as he was a dynamic leader in every undertaking to which he directed his unbounded energies. As a scientist, his colleagues had elected him to the presidency of both of the national entomological societies—The Entomological Society of America and the American Association of Economic Entomologists, a distinction that is shared with only one other person in the last half century. His long service with the Boy Scouts of America had brought him the title of "Councilor of Boy Scouts of the Western States and Hawaii." The citizens of Berkeley had awarded him the Benjamin Ide Wheeler medal for distinguished citizenship for long service on the Berkeley Board of Education and in other civic enterprises. He was president of the California State Automobile Association at the time of his death. Surpassing all these citations, however, are the memories in the minds of thousands of former students of an ideal college teacher—scholarly, friendly, approachable, and infinitely wise.

He was born at Portsmouth, Ohio on September 22, 1876. He graduated from the local school in 1894, and although his heart was set on a career in medicine, his finances were such that he was forced to enter business for four years to accumulate sufficient funds to make possible a college career. He then entered Baldwin-Wallace College from which he was graduated in 1902.

From early boyhood he had seen the ravages of malaria that followed the annual spring flood of the Ohio River, and with the impetus of Sir Ronald Ross' discovery of the transmission of this disease by anopheline mosquitoes, his interests turned to medical entomology. He consistently emphasized the ecological aspects for, as he once phrased it himself, he had "an overwhelming desire to know what goes on in Nature in the Rough."

He won fellowships at Western Reserve, Ohio State, and Harvard. During this time he did pioneering work on the reactions of insects to light which is still considered an authoritative, accurate, and effective starting point for all workers in this field.

In 1908, he was selected from a relatively large field of applicants, several of whom became outstanding figures in entomology, to become Assistant Professor of Parasitology at the University of California. Incidently, he was the first person to hold an academic title in the field of parasitology in the United States.

In the winter of 1909–1910, business men and fruit growers in the Placer foothill country near Penryn asked his aid in reducing the ravages of malaria in that area. He planned an educational campaign among adult groups and in the public schools and, in addition, undertook with the help of his students to carry on an intensive mosquito control campaign over an area of eight square miles. This was the first anti-malarial mosquito control campaign to be conducted in the United States. The district involved was one where a small amount of well planned work was able to accomplish results that verged on the miraculous.

As a result, Professor Herms was called to first one area and then to another to inaugurate mosquito abatement programs for the control of malaria. In many cases it was an up-hill fight, as some local Chambers of Commerce bitterly resented the implication that their communities were centers of malarial infection. With true missionary zeal, however, he fought on, even in the face of personal violence, and lived to see malaria almost eradicated from his adopted state. His record in the control of malaria is shared by but few other scientists in the world. For many years he was Consulting Parasitologist for the State Department of Public Health, and from 1930 until his death he was a Trustee of the Alameda County Mosquito Abatement District, being President of the Board of Trustees in 1949.

It is obvious from his bibliography that he was primarily interested in applicable results, but a perusal of the contents of his papers indicates that he was never interested in what might be called empirical investigations. He used the tools of basic science and was never completely content until he had answered the ultimate "Why" in every piece of research he undertook.

When World War I was imminent, he volunteered his services and was made a Captain and later a Major in the Sanitary Corps. After duty in Texas, he became the Sanitary Inspector at the Port of Embarkation, Newport News, Virginia, where he supervised anti-malarial mosquito control over a widespread encampment area in tidewater-Virginia, with spectacularly successful results. Although over-age at the outset of World War II, he was again called to active duty as a Lieutenant Colonel and supervised the training in Environmental Sanitation for the thousands of prospective army physicians who were indoctrinated at Carlisle Barracks, Pennsylvania.

Returning from World War I he was made head of the Division of Entomology and Parasitology in 1919, a position he held with distinc-

Malaria, a rural disease
5000-6000 cases in California 1909.
Control Campaign
begun in 1909
Penryn Placer County
Life Cycle
of a
Malaria Parasite
C.L.A. Laveran, French, 1880
C. Golgi, Italian; 1885
Ronald Ross, British, 1897-98
W.C. Mac Callum, American, 1897

tion until shortly before his retirement on September 22, 1946.

His text, "Medical Entomology" is one of the most widely used references on the subject in the United States. It is characteristic of his sense of responsibility and his unquenchable urge to keep abreast of his field, that he completed the final typescript of the fourth edition of this work on the day preceding his death.

William Brodbeck Herms was a keen scientist of international repute; an inspiring teacher for many generations of college students; a conscientious citizen who gave of his services unstintingly to all worthy civic proposals; and lastly, a kindly friend whose council was sought in times of trouble, doubt or indecision by countless acquaintances.

His interest in students was University-wide; he was high in the councils of Alpha Kappa Lambda, whose Alpha chapter was formed at Berkeley, and an ardent supporter of the University Masonic Club to which he gave many years of devoted service.

His wide range of friends in all walks of life sympathize with his widow and sons, and mourn his passing; but glory in the fact that because of his living, their lives were made richer and brighter by his presence and example.

Stanley B. Freeborn
Harold F. Gray
Robert T. Legge
Robert L. Usinger

(Note: MOSQUITO NEWS has printed the foregoing tribute to Professor Herms and included the reproduction of his portrait through the courtesy of the California Mosquito Control Association.)

PERCY N. ANNAND

1898–1950

Dr. Percy N. Annand, Chief of the Bureau of Entomology, U. S. Department of Agriculture died on March 29, 1950 following a prolonged illness.

Dr. Annand was widely known for his contributions to the field of entomology, both as a researcher and administrator. Although his research was mainly in the agricultural and horticultural aspects of entomology, he fully recognized the importance of the medical and veterinary branches of the science.

Under Dr. Annand's administration of the Bureau of Entomology and Plant Quarantine the recent important advances in the insecticide field took place, including the development by the Bureau of DDT and various repellents for the protection of military personnel from insect-borne diseases.

Dr. Annand was born in Telluride, Colorado on November 16, 1898. He received his B.S. degree from Colorado Agriculture College in 1920, his M.A. from Leland-Stanford University in 1922 and a Ph.D. from the latter institution in 1928. He was a member or fellow of many scientific societies and served as president of the American Association of Economic Entomologists in 1943. The Department of Agriculture assigned Dr. Annand to investigate a serious insect-borne disease of sugar beets when he joined the staff in 1929. To the solution of this problem he made notable contributions. Before becoming Chief of the Bureau in 1941 he was Assistant Chief of the Bureau's Division of Truck Crop and Garden Insect Investigations, Chief of the Division of Cereal and Forage Insect Investigations and Assistant Chief of the Bureau in Charge of Research.

In Dr. Annand's death the nation has lost an outstanding scientific leader. F. C. Bishopp

LELAND OSSIAN HOWARD
1857–1950

In the death of Doctor Leland Ossian Howard in Bronxville, New York, on May 1, 1950, the world lost one of its most eminent entomologists. Medical entomology was a major field of interest to him and his contributions, particularly to our knowledge of mosquitoes, are monumental.

Dr. Howard was born in Rockford, Illinois, on June 11, 1857, graduated from Cornell University in 1883, and received his Doctor of Science degree from Georgetown University in 1896. He was the recipient of honorary degrees, including an M.D. degree, from several universities. His scientific work on mosquitoes, flies, and the natural control of destructive insects, and his popularization of control procedures attracted attention the world over and brought him various foreign honors, including Officer of the Legion of Honor of France and Officer of the Order of Agricultural Merit of France. He was a member and officer of many scientific societies, permanent secretary of the American Association for Advancement of Science for many years and twice president of that organization.

Dr. Howard was an engaging conversationalist and a voluminous writer. Probably his most important contributions on various aspects of the mosquito problem are his early tests on the use of kerosene as a mosquito larvicide (1892 and 1900) and the popularization of that method of control; his book "Mosquitoes, How They Live, How They Carry Disease, How They are Classified, How They May Be Destroyed," published in 1901 and the four-volume work by Howard, Dyar, and Knab "The Mosquitoes of North and Central America and the West Indies," published in 1914–1917. His books "The House Fly, Disease Carrier" and the "Insect Menace" were among the widely read books in the entomological field.

As Chief of the Division of Entomology, later the Bureau of Entomology, of the U. S. Department of Agriculture from 1894 to his retirement in 1927, and as a world traveler, he exerted a wide influence on all aspects of entomology throughout the globe.

F. C. Bishopp

NEWS AND NOTES

More About the New England Field Trip. East Middlesex Mosquito Control Project.

Dear Miss Trembley: There will be opportunity for our visitors to see the Harvard Museum *if they can be there between 9:00 A.M. and 4:30 P.M.* The Museum is closed outside of these hours.

The possibility of having an excursion through Harvard University Campus has been discussed with Dr. Gerry. We have also considered a sort of panel discussion at the dinner Wednesday evening. Subjects—*Mansonia perturbans* control and any other timely subjects (e.g. progress with pelleted dusts, substitutes for DDT in cases of acquired resistance, etc.). (Catch-basin spraying.)

Dr. Gerry is sending a bunch of programs to Mr. Jobbins at New Brunswick.

Sincerely,
Robert L. Armstrong
Superintendent

Robert L. Armstrong, East Middlesex Control Project, Cambridge, Mass., was absent at the Virginia Beach meetings and missed by his friends. However, he is looking forward to seeing many of us in July. He writes: "Mr. Gerry and the boys up here are gradually getting things arranged for that inspection trip in New England in July. I hope our visitors will enjoy the trip as much as we will enjoy having them up here. The group will probably be in my District from some time Wednesday afternoon until some time Thursday morning. I'm thinking of arranging for rooms at a hotel in Cambridge close to Harvard University."

There is a rumor, too, that a dinner at the famous Toll House in Whitman, may be scheduled!

New England in July (11–14), and a chance to see our Northeastern friends again—almost too good to be true, isn't it? H.L.T.

Abstracts well received:

May 10, 1950

Dear Doctor Collins:

I am delighted to see the abstracts from the MOSQUITO NEWS prepared by you and your colleagues coming along. These abstracts are excellent. They will be published in an early issue of BIOLOGICAL ABSTRACTS.

Thanking you and your colleagues for covering this publication, I am

Sincerely,
John E. Flynn
Editor-in-Chief,
BIOLOGICAL ABSTRACTS

Hoyt to Head Entomology and Plant Quarantine: Avery S. Hoyt has been appointed chief of the Bureau of Entomology and Plant Quarantine in the U. S. Department of Agriculture, Dr. P. V. Cardon, ARA Administrator, announced today. The appointment becomes effective today (April 26). Mr. Hoyt has served as acting chief of the Bureau since the death of Dr. P. N. Annand on March 29. He has been associate chief since 1941.

Mr. Hoyt was appointed a collaborator of the Department in 1912, and became a full-time employee in 1931, when he was appointed assistant chief of the Plant Quarantine and Control Administration, an agency later merged with the Bureau of Entomology to form the present Bureau.

He is a native of San Diego, California, and holds a B.S. degree from Pomona College. Upon graduation in 1910 he was employed by the State in horticultural quarantine work. In 1921 he resigned and went into business for himself. In 1928 he rejoined the State Department of Agriculture and became its head, with the title of Director of Agriculture.

From 1931 to 1934 he was assistant chief of the Plant Quarantine and Control Administration in the Department, and in 1934 became assistant chief of the new Bureau of Entomology and Plant Quarantine. He was named associate chief in 1941. Because of outstanding work in this position he was granted a meritorious promotion in 1942.

Mr. Hoyt is a member of the Washington, D. C., Entomological Society and of the American Association of Economic Entomologists. He lives at 100 North Edison Street, Arlington, Va. He is married and has one daughter. His principal hobby is gardening. — (From U.S.D.A. release dated April 25)

Letter announcing plans for 1951 annual meeting.—Mr. Lester W. Smith, New Jersey Mosquito Extermination Assn., Metuchen, New Jersey.

Dear Sir:

You will be interested to know that arrangements have been made with the Drake Hotel for the 1951 Convention March 6 to 8. This hotel is north of the loop on Michigan Avenue in a very popular shopping district and close to the lake on Lake Shore Drive.

Single rooms for one person range from $4.50 to $6.50 per day, European plan.

Double rooms with twin beds for two persons range from $8.00 to $12.00. They have a few on the lake side of the house at $14.00 per day.

Reservations can be made at any time by addressing Otto McFeely, 200 Forest Avenue, Oak Park, Illinois, for the kind of accommodations desired.

There will be no charge for rooms in which meetings will be held, nor for exhibit space, etc., but a charge will be made for erection and taking down booths in which articles or products will be offered for sale. The Drake has its own booth equipment of standard design.

I suggest that this information be publlished in MOSQUITO NEWS in their next edition, and that you contact key men in different localities to get out an attendance.

J. Lyell Clarke will be contacting you for some suggestions for the program. It will be important to contact contributors as soon as possible. I think we will start the program the afternoon of the first day with hospitality that evening and a banquet the next night. We will arrange for a registration fee, and sale of banquet tickets.

Yours very truly
S. S. Fuller, M.D.
President

Dr. Francisco J. Dy has a new address, which was effective May 1: Dept. of Parasitology, Institute of Hygiene, University of the Philippines, 625 Herran Street, Manila, Philippines. Dr. Dy is Consultant in Malaria and Chief of the Malaria Control Division, U. S. Public Health Service in the Philippines. He is a co-author of an article reviewed elsewhere in this number by Harry Stage.

The following is an excerpt from a letter received by the editor from Dr. Rafael Miranda Franco, Acting Chief, Bureau of Malaria & Insects Control, Department of Health, Santurce, Puerto Rico:

"The *Aedes aegypti* eradication program has just been started. This program is under the sponsorship of the Pan American Sanitary Bureau and it is being financed by the Insular Department of Health. At present we are working at San Juan:

"It might be of interest to you to learn that malaria in Puerto Rico at the present time is being pushed further down in the list of the causes of death in the Island. Last year (1949) there were only 92 deaths reported as caused by malaria compared to 1948 when 253 deaths were reported. The rates for these two years were 4.2 per 100,000 in 1949 and 11.4 in 1948."

Dr. Donald J. Pletsch, Biologist with the U. S. Public Health Service, International Health Division, has written a review appearing elsewhere in MOSQUITO NEWS. On April 3, he wrote to Dr. Glasgow as follows:

"I am not as yet a member of the American Mosquito Control Association but my application for membership has gone forward recently. I have been an interested but somewhat irregular reader of MOSQUITO NEWS and I consider it a delightful combination of technical information and more informal news items of value in promoting effective personal relationships in public health work."

Volume one, No. one, of *Tifa Times*, published by Lister-Todd Engineering Corporation Limited, of London, made its appearance in December 1949. The Right Hon. Viscount Swinton, G.B.E., M.C., wrote the foreword, in which he stressed the need for food conservation and insect control. The remaining 27 pages are devoted to reports on insect control by "Tifa" in India, Saudi Arabia, Egypt, British West Indies, Great Britain, Sudan, Australia, Northern Rhodesia, and the U. S. A. Frank Steinrock, an AMCA member, is quite enthusiastic about this interesting new publication.

Dr. Leonidas M. Deane sent us some reprints recently, and the return address was as follows: Instituto de Malariologia, Caixa postal 2261, Rio de Janeiro, D. F., Brazil.

And do many of you AMCA members know that Dr. A. B. Wethersbee has changed his address from the Naval Medical Center in Bethesda to: 3514 Marie Drive, Apt. 4, Baton Rouge, Louisiana?

John W. H. Rehn (who has a review in this month's MOSQUITO NEWS) is Medical Entomologist for District II, U. S. Public Health Service. He may be reached at: Room 911, 42 Broadway, New York 4, N. Y.

Ralph Van Derwerker, one of our outstanding members, is no longer working with the Pan American Sanitary Bureau. His office is with the U. S. Public Health Service, Federal Security Building, Washington, D. C. He is also very happy to have moved with his family to a new home at 1024 Noyes Drive, Silver Spring, Md.

H. L. T.

Dr. Juan C. Gómez and his lovely wife will be remembered with pleasure by those AMCA members who met them during the 1950 Annual Conferences. Dr. Gómez read a paper at the Virginia Beach meetings and became a member of the AMCA there. On April 3, he wrote from Atlanta, Georgia:

"I will be here until June 5th. After that, you may address me at, Apt. 29, Maracay, Venezuela, S. America. We are having a wonderful time—my wife at the shops, and I at C. D. C. Our best regards. Juan C. Gómez"

A new vitamin "B-T" is being isolated at the University of Illinois. "B-T" was discovered by Dr. G. S. Fraenkel as he studied the nutritional requirements of the larva of the mealworm beetle, *Tenebrio molitor*. The mealworm is a valuable test animal because it is easier to handle than the rat and less expensive, particularly when rare nutritional chemicals are required.

Even though mosquitoes are not involved, the above information is of interest to AMCA members. It appeared in "Chemical and Engineering News," May 8, 1950, on p. 1567, where highlights of the 34th Annual Meeting of the Federation of American Societies for Experimental Biology were summarized. An abstract entitled, "Use of the mealworm, *Tenebrio molitor* in nutritional studies," appeared in the Federation Proceedings, 9(1) Pt. 1:359, March 1950. Although the new vitamin was not mentioned, the

technique employed was apparently that described in the abstract and reported at the meeting. H. L. T.

Virginia Mosquito Control Officers for 1950 are:

President: W. Peyton May
First Vice President: Jonathan S. Gibson
Second Vice President: L. H. Denny
Third Vice President: V. D. McManus
Secretary-Treasurer: R. E. Dorer
Advisory Council: Perry W. Ruth, Chairman, Judge Floyd E. Lellam, Col. James W. Roberts, Stuart M. Gibson, George W. Price, Rear Admiral Carl A. Broaddus.

Many of us will recognize old friends and new acquaintances in the above list; and they will recall the enjoyable meetings at Virginia Beach, where we met these men and their charming wives. Incidentally, the First Veep, Jonathan S. Gibson has a review elsewhere in this number. H. L. T.

Tribute to the ladies (A letter to Perry Ruth).
March 7, 1950

Dear Perry:

We arrived home in good condition after a comfortable trip on the California Zephyr.

The joint Virginia and American mosquito control conference was a pronounced success, and was a tribute to the good planning and management by yourself and Rowland Dorer. Certainly there was nothing lacking in the warmth of our welcome. The four day caravan which you arranged from Virginia Beach to Atlantic City was also unusual and most interesting.

I was distinctly impressed by the ladies on your first day's program, Mrs. Ringgold Miller of the Granby High School, Mrs. H. E. Glidewell of the Federation of Garden Clubs, and Mrs. Floyd T. Sumner of Radio Station WCAV. The interest you have succeeded in arousing among the women of your community must be a great asset in effective control work.

Please convey to Admiral Davis my appreciation of the assistance of himself and his staff in relation to these meetings.

Sincerely yours,
Harold F. Gray
Engineer and Manager

The Alameda County Mosquito Abatement district, as an operating entity of local government, is twenty years old.

On May 28, 1930 the first meeting of the Board of Trustees of the District was held in the office of the Oakland Chamber of Commerce. The Trustees present were:

W. H. Christie, Emeryville
Mark L. Emerson, M.D., Oakland
Prof. William B. Herms, Berkeley
Lester F. Sterner, San Leandro
Louis G. Wolfe, Piedmont

The other originally appointed Trustees not present at the initial meeting, were:

Clifton E. Hickok, Alameda
Prof. Charles Gilman Hyde, County-at-Large
Martin J. Madison, Hayward

The first officers of the Board of Trustees were:

President: Lester F. Sterner
Vice-President: Mark L. Emerson, M.D.
Secretary: Clifton E. Hickok

Mr. Hickok was unable to serve as Secretary, so at the second meeting of the Board of Trustees Prof. Charles Gilman Hyde was elected Secretary, which office he held continuously until his resignation from the Board of Trustees in December, 1946.

The surviving members of the original Board of Trustees are:

Mark L. Emerson, M.D., County Coroner
Clifton E. Hickok, 30 Alta Road, Berkeley
Prof. C. G. Hyde, 2599 Buena Vista, Berkeley
Martin J. Madison, 930 Hampton Road, Hayward
Lester F. Sterner, American Trust Co., Richmond

(News release from Alameda Co. Mosquito Abatement Dist., Oakland, Calif.)

FOR SALE

One (1) Buffalo Turbine Sprayer mounted on a four wheel drive Dodge truck in good shape, $1100.00. Brevard Mosquito Control, Box 42, Titusville, Florida.

EDITORIAL SECTION

This number of *Mosquito News* has departed somewhat from the policy of balancing each issue between the several and varied interests of mosquito control workers. It leans rather heavily in one direction, bringing together new records and assembling with them older records of mosquito occurrence in the northeastern states.

Many of these papers have been awaiting publication for some time. Their length, the added expense of setting in type papers of this kind, and the desire to balance each issue have resulted in their postponement until now we have several on hand. At the same time, most of the other papers awaiting publication are to be published together as parts of the Proceedings of the annual meetings of the American and Virginia Mosquito Control Associations. There is, therefore, the opportunity to bring together in one issue these distribution records.

Even without the aforementioned circumstances, it would be appropriate to have these papers included in one issue. New England, New York, Pennsylvania and New Jersey form the entire northeastern section of the country; yet only in New Jersey do we have mosquito control work on a statewide basis, and as a consequence only there are the mosquito records relatively complete. Especially since the war, however, official entomologists and health officers in the other northeastern states have been urgently solicited by individuals, groups, and communities for information on the mosquitoes of certain areas—information which they often did not have and could not obtain.

In publishing these records for those and other states, the AMCA is fulfilling one of its functions by furnishing a reference basis for workers who will be advising on control, thereby extending control activities to new areas. With the Association organized on a regional basis, it will find itself more and more in the position of organizer of new groups and a sort of missionary and advisor, both as an organization and through individual members.

During the past five years, the *News* and other journals have performed a distinct service in publishing the many studies of occurrence of mosquitoes around military installations, thereby adding to the distribution and other records of the states concerned. The current issue of *Mosquito News* will serve to round out and supplement these contributions.

ASSOCIATION NEWS

MOSQUITO CONTROL WORKERS MEET AT VIRGINIA BEACH

The American Mosquito Control Association scheduled its meetings this year to allow visitors from far away places to take in as much as possible in one trip. A group of delegates met on February 21, at Washington, D. C., to inspect the various mosquito research projects in that area. The National Institutes of Health and the Naval Medical Center as well as the Bureau of Entomology and Plant Quarantine were visited.

From Washington, the group proceeded to Virginia Beach, where a joint meeting of the American Mosquito Control Association and the Virginia Mosquito Control Association was held on February 23 and 24. After the Virginia meetings a party of 75 left the Cavalier Hotel on the morning of February 25 and proceeded on an inspection trip of the work in Virginia, spending the night at Williamsburg. The next day was spent in traveling to Salisbury, Maryland, and the following day was devoted to an inspection of the work in Delaware. After spending the night in Wilmington, an inspection of the work in South Jersey on February 28th was made, finishing up at Atlantic City in time to attend the meetings of the New Jersey Mosquito Extermination Association on March 1, 2, 3. In all it was a very full two weeks and one that will be remembered for a long time especially by those who were fortunate enough to attend throughout.

At Virginia Beach, sixteen states were represented and also Canada, Hawaii, Trinidad and Venezuela. Dr. Stephen M. K. Hu, of Honolulu, came the greatest distance, while a party of 14 came from the far away state of California. A total of 255 delegates registered for the joint meetings. Much dignity and color was added to the meetings by the attendance of high ranking Government officials from several agencies including Rear Admiral Ralph O. Davis, Commandant of the Fifth Naval District and his entire staff.

Perhaps the most interesting and informative session was a panel discussion led by Dr. F. C. Bishopp, entitled "Today's Problems in Controlling Mosquitoes and Latest Recommended Insecticides." Those participating in the discussions included Dr. W. V. King, Orlando, Florida, Mr. Arthur Geib, Bakersfield, California, Mr. T. G. Raley, Selma, California, Mr. Harry Stage, Washington, D. C., Dr. D. M. Jobbins, New Brunswick, New Jersey, and Mr. P. F. Springer of Maryland. At the end of the discussion several speakers made contributions from the floor and Dr. Bishopp concluded by summing up the proceedings.

It is not possible in a short synopsis to sum up the many worthwhile things brought out at Virginia Beach. The program was well balanced with papers on interesting technical developments, seasoned with practical experiences from many states. Several important business sessions of the American Mosquito Control Association were held, including the election of the officers for the coming year. It is planned to publish the proceedings in booklet form or in a special issue of Mosquito News, where those who could not attend or those who wish to review what was said can read what happened in full.

Virginia has always been known for her hospitality and every effort was made to insure that all who came to Virginia Beach had a good time. The Virginia Beach Chamber of Commerce, the Town of Virginia Beach and the County of Princess Anne, all contributed to entertaining the guests. When the delegates were not in session a hospitality hour was set up in the hotel lounge where everyone could and did relax in the atmosphere of "open house" to discuss their mutual problems in an informal way. It was here that the peculiar aspect of the Mosquito Association Convention was most apparent. The sun-burned field worker spoke with as much authority as the skilled and learned technician and each respected the contributions of the other. Such an attitude of mutual respect is one of the major factors in the great strides made in mosquito control.

The real feature of the convention was family atmosphere. The intermingling of delegates made it possible for everyone to know one another. Many mosquito workers brought their wives and children and all seemed to enjoy the proceedings equally. The two-day activities were concluded with a banquet. Dr. Hu, of Honolulu, added to the festivities by contributing leis, which he had transported from Hawaii for the occasion. After an excellent dinner a quartet of Cavalier waiters rendered "Carry Me Back To Ole' Virginy," and several other numbers. Judge Floyd E. Kellam, of Princess Anne County, was toastmaster and Dr. Rowland P. Wagner, Baptist minister, gave as entertaining an after-dinner talk as has ever been heard. Carried through his talk was the theme "What a great thing is cooperation." But every time he commenced to get serious, he would joyfully jump into another story on himself or his congregation. Dancing, until — ? —, concluded a very full two days.

Publicity for the meeting was very good. A total of 181 inches of column space including five pictures was carried in the local papers. Several articles by Frank Carey, Associated Press from Washington, who covered the entire meetings were published in newspapers throughout the country. In addition, radio commentators included interesting items on the meeting on their national broadcasting hook-ups.

Meetings of this sort are of value because of the information gained through listening to the papers and from the many informal conversa-

Top: Members of the AMCA. Group picture taken in front of Cavalier Hotel.
Bottom: U. S. Navy officers and officers of American Mosquito Control Association who were present at Virginia Beach meetings. Left to right: Capt. F. K. Smith (MC), USN; Capt. A. I. Flaherty (CEC), USN; Rear Admiral Ralph O. Davis, Commander Fifth Naval District; Harold F. Gray, Outgoing President American Mosquito Control Association; Percy W. Bird, Past President American Mosquito Control Association; Lester W. Smith, Incoming President, American Mosquito Control Association; Rear Admiral Carl A. Broaddus (MC), USN; Dr. Don M. Rees, President Utah Mosquito Abatement Association; Rear Admiral A. G. Bisset (CEC), USN; Capt. A. D. Alexis (CEC), USN. *Official U. S. Navy Photograph.*

tions with men from various parts of the world with similar problems. However, a point probably overlooked is the benefit in furthering mosquito control work in Virginia, which will be the outcome of the American Mosquito Control Association meeting in Virginia. More citizens and influential leaders in Virginia are now aware of the mosquito movement.

ROWLAND E. DORER
Chairman Committee on Arrangements
PERRY W. RUTH
Chairman Program Committee

By special arrangement: A snowstorm on the cavalcade, for the benefit of the Florida and California delegates. Left to right, Fred Stutz, Art Geib, Lester Smith, Duke Peters.

NOTICES

It was hoped to publish the membership list in the June number, but with the new names recently added and others being added as a result of the membership drive stimulated by the meetings at Virginia Beach, it became necessary to postpone publication of the list until the September number. It is planned that the September number, besides including the supplement containing the *Proceedings* papers, will include the membership list, and the bylaws adopted at Virginia Beach.

Detailed information on the field trip in the Massachusetts Bay area is given in the March number of the News. The dates are July 11–14. See also letters printed in *News and Notes* in the present (June) issue on page 95.

REVIEWS AND ABSTRACTS

A MALARIA SURVEY OF LIBERIA. By Martin D. Young and Thomas H. Johnson, Jr. Journ. Nat. Mal. Soc. 8(4):247–266. 1949. Under the auspices of the U. S. Public Health Service and the Republic of Liberia, a survey was made to determine the incidence of malaria in Liberia. Between May and October 1948, bloodsmears were made in representative villages and schools from the coast to the mountains of the interior. Thick and thin smears were taken from each subject. Most of the slides were examined at USPHS laboratories in the United States. Density of parasites was measured by the ratio to the white blood corpuscles and it was assumed that 650 w.b.c. represented 0.1 cubic mm. of blood. Of 10,128 blood smears taken, 30.65% had malaria parasites. The percentages of infections for each species of plasmodium were: *P. falciparum,* 83.8%, *P. malariae* 14.2%, *P. vivax,* 2.0%, and *P. ovale* only one case. Infections are compared in age groups. Malaria was hyperendemic throughout the country increasing in intensity toward the interior.

A mosquito survey included the collection of adults in resting places, dissections of salivary glands, and collections of larvae. Apparently no night collections of adults were made. Of 1,153 adult Anopheles taken, 1,087 were *A. gambiae,* 60 were *A. funestus,* 3 were *A. hancocki,* and 3 were *A. nili.* This required 100 man hours of collecting time. The 543 *A. gambiae* dissections showed 6.45% infected with malaria. This species was considered the most important malaria vector. Larvae of *A. gambiae* were able to survive in cracks in mud after pools dried up. The species was breeding in a wide range of pools, water-filled tracks and depressions and containers. *A. melas* larvae were found in salt flats on the coast near Clara Town and this is believed to be the first report of the species from Liberia.

It is interesting to note the report that in this country of many tribes of Negro aborigines, the small number of leaders and better-educated individuals are nearly all descendants of Negroes returned 'from America! Yet there are many government, mission, and other schools in Liberia. —R. L. Armstrong, East Middlesex Mosquito Control Project, Cambridge 39, Mass.

TWENTY-SECOND ANNUAL REPORT (1949) OF THE DESPLAINES VALLEY MOSQUITO ABATEMENT DISTRICT. Lyons, Illinois. 1950. 29 pp. The report contains some interesting information on the spraying of a forest reserve with DDT. This study involved a careful check on the effects of the application of 0.1 lb. of DDT per acre as a thermal aerosol and by means of a mist blower on various species of mosquitoes, other insects, fish, amphibians, birds and mammals. This work was carried out by William Tietz, Jr. under the supervision of H. H. Ross of the Illinois Natural History Survey. In addition to the treatment of plots with DDT, one area was sprayed by hand with 5% chlordane. Mr. Tietz concluded that mist applications at 0.1 lb. per acre were not harmful to birds and that the fogging at the rate of 0.1 lb. per acre or 0.5 lb. per acre produced no important depression of the total biota. The report also contains interesting material on routine village fogging with DDT and routine mosquito and fly control operations. Light trap collections show *Aedes vexans* to constitute 68.3% of the catches and *Culex pipiens* 23.2%. The other 17 species caught were present in relatively small numbers. The Desplaines Valley Abatement District contains 76.5 square miles and a population of 195,888.—F. C. Bishopp

EFFECTS OF DDT MOSQUITO LARVICIDING ON WILDLIFE V. EFFECT ON FISHES OF THE ROUTINE MANUAL AND AIRPLANE APPLICATION OF DDT AND OTHER MOSQUITO LARVICIDES. C. M. Tarzwell. Pub. Hlth. Repts: 65(8):231–255. 1950. The effects of DDT and other mosquito larvicides on various forms of life have been investigated for some time. The present paper dealing with the effect on fishes, has been looked forward to by many workers. This careful, detailed study is a must for those who have to consider the effects of their larviciding programs on wildlife.

Other agencies and workers have studied and discussed the effect of single treatments with various dosages of DDT. This paper deals with the effects of repeated applications, such as those necessary for a malaria control larviciding program.

The tests were carried on in small to moderate-sized pools and ponds. As a result, there was little chance for runoff, and concentrations of larvicide were probably built up. For this reason conditions were more severe than would be found in many areas with routine applications.

The toxicity of various solvents was tested in manual applications. Where two or more gallons per acre were used, it was found advisable to use kerosene or some other less toxic solvent. When used at one gallon per acre, the difference between most samples of No. 2 fuel oils and kerosene did not appear to be significant.

DDT emulsions were found to be more toxic than solutions and dusts, and are not recommended where there is valuable wildlife.

Single applications of solutions at 0.4 pounds or more of DDT per acre were toxic, while solutions in dosages of 0.1, 0.05 and 0.025 pounds per acre, and dusts at 0.1 and 0.2 pounds per acre did not kill fish.

Repeated applications of DDT solutions at a dosage of 0.1 pound of DDT per surface acre generally resulted in serious kills of fish after the

tenth application. The type of pond greatly influenced the effects, mortality occurring earliest in barren sand bottom ponds. Generally, routine weekly treatments at 0.1 pound of DDT per acre were significantly harmful to fish and are not recommended for malaria control where fish are important. Routine treatments with solutions at dosages of 0.05 pounds of DDT per acre resulted in harm to fish after the third to eighteenth treatment. No dead fish occurred in ponds routinely treated with 0.025 pounds of DDT per acre. For adequate malaria control, oil solutions applied at doses of 0.05 pound of DDT in one gallon of solution per acre are generally recommended.

DDT dusts can be applied routinely at 0.1 pounds of DDT per acre with little or no significant harm to aquatic organisms.

It is concluded that DDT sprays or thermal aerosols from airplanes can be routinely applied at a discharge rate of 0.1 pound per acre for up to 3 years without harm to fish.

The type of pond or water in which DDT is used greatly influences the onset and severity of toxic action on fishes. Vegetation, organic material, type of water, as well as silt or turbidity are all factors influencing this action.

With repeated applications of dosages of 0.1 pound per acre, DDD, chlordan and DDT are toxic to fish after 10 applications. At dosages of 0.05 pound per acre per week, DDT appears to be somewhat more toxic than chlordan or DDD. Toxaphene was found to be very toxic to fishes, while DDD was considerably less toxic than DDT. No significant effect on fish was noticed at dosages of 0.025 pound per acre with DDT, DDD and chlordan. "For adequate malaria control, oil solutions applied at doses of 0.05 pound of DDT and one gallon of solution per acre, or dusts applied at 0.1 pound of DDT per acre, are generally recommended."—J. W. H. Rehn, U. S. Public Health Service, New York, N. Y.

THE EFFECT OF VARIOUS INSECTICIDAL COMBINATIONS IN INCENSE COILS ON *Culex fatigans*. By H. T. Chang. Incense or smudge coils, containing an insecticide, are widely used in China for protection against mosquitoes. Such coils are especially desirable for use around unscreened dwellings. The most commonly used insecticidal ingredient is ground pyrethrum flowers. The proper concentration of pyrethrum in the combustible filler is unknown. Laboratory studies were made with 59 different combinations against adult mosquitoes, *Culex fatigans*.

The experimental coils were prepared by mixing insecticide, sawdust, and powdered elm bark, adding water until a dough-like mass was formed and passing this through a small tube to form ropes of the material, usually about 1 meter long and 5 mm. in diameter. The air dried weight of one of these was 57 grams and one would burn for about 7 hours.

Approximately 50 mosquitoes were used per test in one series and about 100 per test in another. These were placed in screen cages of about 3.5 cubic feet. To confine the smoke, a black cloth was placed over the cage. One side of the cage was open and this was placed on a white sheet of paper to facilitate counting of down mosquitoes.

In the first series of tests, in which 40 different combinations were used, counts were made 10 and 20 minutes after the burning coil was placed in the cage. In a second series of tests 19 additional mixtures, as well as two previously tried, were included. In this series, counts of down mosquitoes were made at 5 minute intervals up to 20 minutes after treating with the smoke. In this series the period of exposure to the smoke was limited to 5 minutes. Recovery of knocked down mosquitoes was negligible.

In the first series of tests little or no effectiveness was obtained from coils containing DDT, BHC (Gammexane 0.5%), sulfur, arsenic, D.H.C. activator and derris alone or in combination with pyrethrum. Spraying of the coils with pyrethrins solution was beneficial but impractical. Three Stars brand was as good as any of the commercial lots tested. Coils containing 40% pyrethrum flowers and 3% Thanite gave very good results.

The Three Stars brand and the pyrethrum-Thanite combination showed up well in the second series of tests also. The chlorinated hydrocarbons chlordane and toxaphene, as well as those mentioned above, had no merit in combination with pyrethrum. The addition of 3% of Pyrenone, which contains pyrethrins and Piperonyl Butoxide, results in an effective combination. Mixtures of pyrethrum and tobacco were quite effective.—R. H. Nelson. (Abstract of unpublished paper. Paper as submitted contained material that required revision and condensation. The author could not be reached, so the editor has printed Mr. Nelson's revision or abstract in place of the original, longer version.)

CAN MALARIA BE CONTROLLED IN THE PHILIPPINES BY DDT RESIDUAL SPRAYING OF HOUSES? By Howard F. Smith and Francisco J. Dy. Acta Medica Philippina 6(2): 81–111, 1949. Reports from different parts of the world have mentioned the effectiveness of DDT residual sprays in houses and outbuildings as a malaria control measure. This article by Drs. Smith and Dy informs us, however, that DDT residual spraying in Philippine houses and outbuildings to control *Anopheles minimus flavirostris* Ludlow was not effective in controlling the disease nor reducing this species of anopheline. The authors are of the opinion that their apparent failure was most likely due to the wild nature of the vector because it does not stay indoors long enough to permit sufficient contact with the DDT treated surfaces. The authors' preliminary observations indicate also the type of building materials such as nipa and bamboo, used in rural Filipino communities, did not retain DDT residue as well as wood and

other building materials. The experiment was conducted over a period of 12 months in three separate groups of malarious communities. Of a total of 1704 mosquitoes collected over a period of 8 months from the floor of a number of houses that had been sprayed, not a single *A. minimus flavirostris* was found among 253 other anopheline and 1451 culicines.—H. H. Stage.

AN OUTBREAK OF SYLVAN YELLOW FEVER IN UGANDA WITH *Aedes (Stegomyia) africanus* THEOBALD AS PRINCIPAL VECTOR AND INSECT HOST OF THE VIRUS. By K. C. Smithburn, A. J. Haddow, and W. H. R. Lumsden. Ann. Trop. Med. and Parasit. 43(1):74–89. 1949. Through the employment of rhesus monkeys stationed as sentinels in the canopy of uninhabited forest, a focus of sylvan yellow fever was located and defined. The sylvan outbreak continued for at least 5 months. *Aedes africanus* was identified as the sole mosquito host and vector among the species captured; the disease was transmitted by the bite of wild-caught members of the species, and yellow fever virus was repeatedly isolated from the same species over a period of 3 months.

Yellow fever virus was isolated from a monkey which had received inoculations of *Phlebotomus* spp., but only after an uncommonly, but not impossibly, long incubation-period. Further studies are required to determine if *Phlebotomus* spp. can play a part in the epidemiology of yellow fever.—Authors' summary.

PROCEEDINGS AND PAPERS OF THE SEVENTEENTH ANNUAL CONFERENCE OF THE CALIFORNIA MOSQUITO CONTROL ASSOCIATION HELD JOINTLY WITH THE ANNUAL CONFERENCE OF THE AMERICAN MOSQUITO CONTROL ASSOCIATION. February 7, 8, 9, 1949. Edited by H. F. Gray, R. F. Peters, and G. E. Washburn. The meetings were held at the University of California in Berkeley and at the Hotel Claremont in Oakland, California, and were presided over by various representatives. The American Mosquito Control Association of a year prior to the meetings no longer exists. It has been incorporated under the laws of the State of New Jersey and is now known as the American Mosquito Control Association Incorporated.

An excellent color reproduction of a portrait of the late Professor William B. Herms is included in the *Proceedings* in memory of the beloved Professor of Parasitology, University of California, and "Savant in Malariology, Father of California Mosquito Control; Inspiration to Mosquito Control Workers Everywhere."

S. D. Macready reports on 3 years observations in the use of DDT residual spray for the control of *Anopheles albimanus* in tropical labor camps. Diesel oil is being used as the vehicle for DDT rather than kerosene and is applied to camp walls to an average height of ten feet. Two treatments a year have proven entirely satisfactory and all anti-larval measures have been stopped except in some localized breeding places.

The problem of insect vectors of yellow fever in the Anglo-Egyptian Sudan is discussed by Dr. E. S. Horgan. It is brought out that in a major epidemic of yellow fever in the southwestern Sudan the part played by *Aedes aegypti* was probably negligible. Strong circumstantial evidence indicated that the most important vectors were *Aedes vittatus* and *A. furcifer* (with *taylori*). This does not mean that *A. aegypti* is of minor importance, and much attention is paid to its control in the Sudan.

Mosquito workers would be interested in reading an account of mosquito control problems in Japan given by Major Walter J. LaCasse. An excellent history of mosquito borne diseases in Japan, together with discussions on mosquitoes as disease vectors, is given.

Public health problems relating to the viral encephalitides in the Far East and the Pacific Islands by W. McD. Hammon is a very interesting account of the vectors and mosquito borne disease of the Islands with a discussion on the possibilities of the introduction of certain diseases to the United States.

The role the Public Health Service plays in the malaria program carried on cooperatively with State Health Departments is adequately handled by G. H. Bradley. It has as its objective the eradication of malaria from the continental United States.

T. D. Mulhern's report from New Jersey, with special reference to the utilization of temporary versus permanent control methods, M. W. Provost's discussion on mosquito problems in Florida, P. W. Ruth's paper on mosquito control in Virginia, J. L. Clarke's report from Illinois, D. M. Rees' report from the Utah Abatement Association, E. E. Lynch's two-year summary of airspraying in Delaware and A. H. Dahl's progress of mosquito control in California give the reader important information on control operations in these states.

In A. W. Lindquist's discussion of pre-hatching treatment for mosquito control he states that the method may have widespread use in many areas on many types of mosquitoes, such as flood water, salt water, and Alaskan *Aedes,* and snow water mosquitoes. He further states that the good results obtained are probably due to the ease with which newly hatched larvae are killed.

The problem of the use of new insecticides as residual sprays against adult mosquitoes is covered by G. H. Bradley while the toxicity of insecticides to man and animals is covered by A. B. Lemmon. Their effect on wildlife is discussed by O. B. Cope.

The place of education in a mosquito abatement program by Dorothy B. Nyswander and the relationship of mosquito abatement agencies to other agencies of government by S. B. Freeborn gives a clear picture of the responsibilities engendered in mosquito control operations.

The research on mosquito control by the Bureau of Entomology and Plant Quarantine during 1948

is given in the *Proceedings* as well as specific projects such as the use of tide gates, low-lift pump, and transportation on salt marsh.

The above plus the many subjects discussed in the symposium make the *Proceedings* well worth adding to any mosquito control worker's library. —John D. DeCoursey, Bureau of Medicine and Surgery, Navy Department, Washington, D. C. (Editor's note: copies of these *Proceedings* are available at CMCA headquarters, P. O. Box 649, Berkeley 1, California. $2.50.)

HANDBOOK FOR MOSQUITO RESEARCHERS: STUDIES OF JAPANESE MOSQUITOES. 1948, pp. iv–210, 84 figs. (in Japanese). SASA, Manabu, of the Research Institute for Infectious Diseases, Tokyo, and ASANUMA, Kiyoshi of the Natural Resources Research Institute, Tokyo; Publ. by Tokyo Shuppan Co., Ltd., 350 yen.

This volume, originally conceived as a text for students of Japanese mosquitoes, nominally covers many phases of interest to such workers. Introductory generalizations on the importance of mosquitoes are followed by a list of species including 5 *Anopheles,* 15 *Culex,* 17 *Aedes,* and one species each for 7 other genera. Twenty-five pages are devoted to ecology of adults and larvae, hibernation problems, and geographic distribution. Descriptions and keys for classification of eggs, larvae, pupae and adults are treated in 140 pages. Investigative methods, including collecting, rearing and dissections are only briefly outlined, as are assay methods for anti-malarial drugs and the use of mosquitoes in virus research. The bibliography includes 180 titles.

In the authors' note concluding the volume, acknowledgment is made of help received during brief contact with W. J. La Casse and Sachu Yamaguchi, authors of "Mosquito Fauna of Japan and Korea" (see *Mosquito News* 8(4):200–201) and from others.

The paper stock available for printing in Japan in 1948 was obviously of very poor quality, although half-tones included on 3 inserted pages of superior stock are excellent.

A translation of the foreword, table of contents, keys to adult Japanese *Culex,* bibliography, and authors' note, has been accomplished by Toyohi OKADA, Japanese dipterist employed by the Scientific and Technical Division, Economic and Scientific Section, General Headquarters, Supreme Commander for the Allied Powers. Copies of the translation have been forwarded to the Army Medical Library and to the Office of Technical Services, Washington, D. C. Other copies have been furnished the 406th Medical General Laboratory, Tokyo, and the Public Health and Welfare Section, GHQ, SCAP.—D. J. Pletsch, International Health Div., U.S.P.H.S., Washington, D. C. (Ed. Note: In April, about 360 Japanese yen equalled $1.00 U. S.)

COMMENTARY ON A MALARIA SURVEY OF MACHAKOS DISTRICT BY J. C. J. CALLANAN. By D. Bagster Wilson. East African Med. Journ. 26(12):386–390. 1949. *Comment.*—There may be some doubt about the detailed interpretation of these results but they give in the first place a very comprehensive picture of the distribution and endemicity of malaria in Machakos District. They also show how great a disturbance seasonal malaria can create among the Bantu tribe of the Akamba, as it still does. There is no doubt at all that such outbreaks are responsible for a great deal of sickness among these people. A great proportion of the breeding of *A. gambiae,* which is almost the only vector found, occurs in streams, with some also in springs, and the facilities for such breeding are to a great extent dependent on the condition of fullness or otherwise of these streams.

It is difficult to indicate, in most cases, what may be regarded as the "normal" endemic indices, either for an area or for individual places. Such apparent inconsistencies in the endemic indices as have already been pointed out, possibly arise from the normal occurrence of seasonal variation superimposed on what was an exceptional epidemic. Thus in Table IV the spleen rates have fallen from their high peak in the major epidemic, but parasite rates are tending to reflect the rising seasonal tide of malaria and show no corresponding decrease. This is even more so in Table III, in which at the first examination the spleens were at their greatest but parasite levels had already begun to drop, whereas at the second examination spleen rates were falling but parasite rates beginning to rise again. Unfortunately there are few clear comparisons between conditions before this epidemic started and later; but the few shown in Table III give a clear enough indication of a very low initial endemic level (possibly following a succession of years of slight malaria) being raised to a peak figure by the year's events.

Summary.—A series of parasite and spleen rates in children in the Machakos District of Kenya is recorded. These were observed over the period of an epidemic of malaria, and their significance in relation to this epidemic is discussed.—Author's Summary.

SUMMARY OF THE ANNUAL REPORT OF THE ALAMEDA COUNTY MOSQUITO ABATEMENT DISTRICT, OAKLAND, CALIFORNIA. Prepared by Harold F. Gray, 1-A Court House, Oakland 7, Calif. Feb. 1st. 1950. A comprehensive and orderly report reflecting the business acumen and engineering ability of the District's management. It includes the operation and maintenance of the District and how its services are performed.

Covering an area of 445 square miles with a population of 700,000 and a budget of $101,-297.97, financed by a tax rate of 1.6 cents per $100.00 of assessed valuation, the residents of the County are getting services worth much more.

Four genera and 17 species of mosquitoes have been collected. Brief non-technical information

concerning these species is given and should prove to be of value to the layman in his understanding of the problems involved in mosquito control. The Anopheles group is rare in the District. The news that canine filariasis or dog heartworm is enzootic in the San Francisco Bay region is of particular interest. Where this disease is endemic various mosquitoes have been identified as vectors, particularly such common species as *Culex pipiens* and *Aedes aegypti.* Investigations carried out by I. M. Roberts, D.V.M., in East Oakland recently, has thrown more light on canine filariasis in that region. Reasons for the low count of microfilariae found in California dogs compared with average cases studied in the Southeastern States would be welcome. The fact that the largest number of animals examined in the study were from an area infested with *Culex pipiens, Culex tarsalis,* and *Culiseta incidens* has caused the Authority to investigate further the respective life histories of these species with a view towards a more critical approach to control.

It is noted that West Coast residents share, with most other U. S. citizens, a belief that the mosquito control authority can and should extend their control to flies, rats, and other pests. thereby giving recognition to the effectiveness of mosquito control. Also the problem of breeding outside of the district's boundaries is met by actual spraying of adjoining infected areas. The solution, of course, is to secure the organization of mosquito control in adjacent territory.

Construction of dykes, re-claiming salt marshes, bushing of streams, building access roads and trails, tractor work, equipment maintenance, catch basin treatment in cities and urban areas, the use of various insecticides, management and use of personnel, and publicity (a feature with which mosquito control authorities are notoriously reticent), are all a part of a report with which each mosquito control agency should avail itself. —J. S. Gibson, Warwick County, Virginia.

EFFECT ON THE DARK RICE FIELD MOSQUITO OF FEEDING ON COWS TREATED WITH DDT. F. E. Whitehead. Journ. Econ. Ent. 42(2):393–394. 1949. A technique is described for caging mosquitoes on cows treated with DDT and obtaining fatality records resulting from such feedings. Data taken on 1160 mosquitoes *(Psorophora confinnis* A-L) gave the following indications: DDT applied to cattle has no repellent effect. DDT applied to cattle at the rate of 20 lbs. of 50% wettable powder in 100 gallons of water will kill from 53 to 84 per cent of the mosquitoes feeding on them for a period of 9 days, but very few thereafter. Applied at the rate of 5 lbs. per 100 gallons, there results a fatality rate of approximately 75 per cent for a 3-day period and then drops off rapidly. It is thought that the reason for the comparatively low fatality rates resulting from these feedings may be due to the small amount of time these mosquitoes spend on the cows in obtaining a blood meal. These results cast considerable doubt on the soundness of recommendations that cattle be sprayed with DDT to protect them from mosquitoes.—Author's summary.

DADE COUNTY ANTI-MOSQUITO DISTRICT 15TH ANNUAL REPORT, 1949. 14 pp. Fred H. Stutz, Director; James H. Heidt, Entomologist, Rm 1909, Dade County Court House, Miami, Fla. Salt marsh species were more annoying than *Psorophora confinnis;* there were no flights of these in 1949. Salt marsh breeding *Aedes sollicitans* has a marked resistance to DDT and has increased in breeding and annoyance since 1946. No *Anopheles quadrimaculatus* were caught in mosquito light traps. Airplane spraying covered approximately 32,254 acres at .2511¢ per acre excluding truck servicing, mixing and supervision. The district participated in sand fly studies. Space spraying of DDT at drive-in theaters proved effective against sand fly adults.—John W. Scott, State of Vermont Department of Agriculture, Montpelier, Vt.

MOSQUITO SURVEY IN VERMONT, REPORT #2, 1949. 8 pp. John W. Scott, Mosquito Research Engineer, State of Vermont, Department of Agriculture, Montpelier, Vermont. The overall mosquito annoyance in Vermont was light as a result of a dry summer for 1949; the town of Newport was an exception. Early spring type, single brooded mosquitoes were predominant; few flood water species appeared. Space spraying against adult mosquitoes was reduced to a minimum.—J. W. S.

SUMMARY OF THE ANNUAL REPORT OF THE SALT LAKE CITY MOSQUITO ABATEMENT DISTRICT FOR 1949. Prepared by Don M. Rees, 401 City and County Bldg., Salt Lake City, Utah. Control of mosquitoes within the District was very effective and no large broods escaped during the season. There was approximately 50% reduction in average nightly light trap catch in 1949 compared to previous 5 year average. Two invasions of *Aedes dorsalis* from outside the District occurred; a severe flight in June, a lighter flight in September. Continuously breeding *Culex tarsalis* within the District was still the dominant species trapped. Climatic conditions with the exception of May were favorable for mosquito control. Additional equipment purchased included a station wagon, jeep, and two 3-wheeled motorcycles. Airplane larviciding was used for the first time in the District. Pre-hatch treatment for control of *Aedes dorsalis* appears to be satisfactory: results of such treatment made in fall against early spring broods in 1950 will be observed. Approximately 250 acres of gnat (*Leptoconops kertezi* var. *americanus* Carter) producing ground was successfully treated during 1949.—J. W. S.

ANNUAL REPORT UNION COUNTY MOSQUITO EXTERMINATION COMMISSION 1949. 15 pp. 6

plates. George E. Powers, Supt. and Secretary, 324 North Ave., Cranford, N. J. Unique cover showing biting mosquito on front-face and life story of mosquitoes on back-face, all in color. Includes 4 photos of headquarters and new shops. Low rainfall during season 15.05 inches with above average temperatures. Mosquito light trap average 1.3 per night for 1949, and 34.0 for 1948. Pre-emergence spray of 5% DDT in fuel oil was applied to pooled waters in February and March for residual effect. A Caterpillar motor was installed as power unit for Lawrence salt marsh pump. A Tifa fog generator and 3 pick-up trucks were purchased. A new larvicide mixing room and repair shop were built. Newark Airport expansion and new super-highway construction on Elizabeth salt marsh will create breeding problems.—J. W. S.

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	PAGE
American Mosquito Control Association	III, X
John Bean Mfg. Co.	XI
Brevard County Mosquito Control	98
California Spray Chemical Corp.	V
Dyna-Fog. Corp	IV
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Insect Wire Screening Bureau	VII
LeHava Air Services	VIII
F. E. Myers & Bro. Co.	IX
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